

Evaluation of the effectiveness of play@home

March 2011

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Summary of key findings

Baseline Cross-sectional Observations revealed:

Baby group

- No differences were observed in any of the measurements for the Baby group between the Intervention and Control areas.

Toddler group

- Higher levels of the Ages and Stages Questionnaire assessment scores were found in the Toddler Intervention group compared with the Toddler Control group. In particular, statistically higher scores were observed for Gross Motor, Fine Motor and Problem Solving Ages and Stages Questionnaire sub-domains
- Higher scores were found on the Pleasure in Parenting Scale for the Toddler Intervention group with parents scoring significantly higher on three specific questions relating to “mealtime activity”, “tidying away toys”, and “parent-child errand activity”
- In addition, for the Toddler Intervention group alone, a statistically significant correlation was observed between selected sub-domains in the Ages and Stages Questionnaire assessment and the Pleasure in Parenting Scale.

Pre-school group

- In the Pre-school group, no significant differences were observed in habitual physical activity levels between the Intervention and Control groups
- A statistically significant difference was observed for assessment scores with the Pre-school Intervention group reporting higher scores for the Ages and Stages Questionnaire Fine Motor skill sub-domain. No significant differences were observed for Shared Activities Questionnaire responses.

Taken together, and with the caveat that these are cross-sectional observations, these data appear to indicate that the play@home resource was particularly associated with higher levels of development (as measured by the Ages and Stages Questionnaire) amongst the Toddler Intervention group. Exposure to the resource in the Toddler group also appears to be reflected in reports, by the primary carer, of higher levels of parent-child engagement. This conclusion is based, in part, on the absence of any differences at the time of initial receipt of the resource in the Baby group but the observed presence of such differences between the Intervention and Control groups at the Toddler stage.

Longitudinal Observations

Only one significantly better scoring outcome was identified in the play@home Intervention group compared to the Control group:

- Post intervention, a significant effect was seen for percentage time spent in moderate to vigorous physical activity wherein the Intervention group was seen to improve more than the Control group over the evaluation period

- This increase in percentage time spent in moderate to vigorous physical activity, for the intervention group alone, constituted a 28% relative increase in moderate to vigorous physical activity above baseline values corresponding to a mean increase of 7.2 minutes per day in time engaged in moderate to vigorous physical activity
- If this observation were to be extrapolated to a one week period, the Intervention group would potentially accrue approximately 50 minutes extra moderate to vigorous physical activity per week in comparison with their baseline activity levels. None of the changes favoured the comparison site.

Exit Survey

- Exit survey information obtained from almost 100 of the play@home Intervention group (~33% of the total intervention sample) revealed that well over two thirds of the sampled Baby (86%), Toddler (85%) and Pre-school (67%) participants, found the resource to be either 'Very Useful' or 'Useful'.

Executive Summary

Background

To date there have been very few research trials or evaluations of the effectiveness of family-based Early Years interventions for physical activity promotion. Moreover, previous evaluations of many Early Years physical activity promotion intervention schemes have understandably focused on implementation processes, outputs (e.g. distribution, access to and uptake of programmes) and short-term outcomes (knowledge, skills, abilities) with, at this time, very little evaluation of their longer-term effectiveness.

play@home is a physical activity promotion programme for children from birth to five years which promotes interaction and loving touch to encourage bonding between parent and child. The play@home programme has been developed on the philosophy that parents and carers are children's first educators. In this regard parents/carers are considered to have a crucial role to play in encouraging children to develop friendships and interact with situations outside the family home. The programme is not only about what parents/carers can do for children, but just as importantly, what parents/carers can do with their children.

The play@home programme is designed to provide parents and carers with activity ideas for playing with their child from the earliest days. Resources are provided to parents, including three books for the target ages of 0-1 years, 1-3 years, and 3-5 years with inexpensive, easy-to-follow ideas and activities that assist parents with the challenges of parenthood and childcare. The books include activities for babies and children to stimulate their curiosity, imagination and creativity and influence overall development through play activities, movement to music and interaction with other children and adults. The resources are designed to (i) provide parents and carers with free information and guidance, (ii) encourage children's enjoyment of physical activity and play from an early age, (iii) encourage communication through talking and listening, (iv) develop body awareness and promote the development of physical movement, coordination and motor skills, (v) promote the value of social interaction and stimulus so that children learn to interact socially and communicate, and (vi) promote the value of physical touch and positive reassurance.

Aims and objectives

The aim of this evaluation was to measure the effectiveness of play@home in meeting its key programme outcomes (for Babies, Toddlers and Pre-school age children) namely, improved:

- a. physical activity and motor skills
- b. cognitive and social development
- c. parent-child bonding.

The specific outcome measures used for the Baby and Toddler groups were the Ages and Stages Questionnaire as the primary outcome and the Pleasure in Parenting Scale

as a secondary outcome. The primary outcome measure for the Pre-school (4-5 years) group was the child's total daily physical activity assessed via accelerometer measurement (expressed as mean counts per minute). A secondary physical activity outcome for the Pre-school groups included measurement of intensity-specific sub-domains of physical activity behaviour (e.g. percentage of accelerometer wear time spent sedentary, and in moderate-to-vigorous physical activity) Additional secondary outcome information was obtained from parental self-report completion of the Ages and Stages Questionnaire and the Shared Activities Questionnaires

Method

The research aims were addressed by conducting three independent evaluations of the effectiveness of play@home with its three target groups: Babies, Toddlers and Pre-school children. To maximise the recruitment to, and facilitate operational management of, the evaluation consisted of a non-randomised, pre-post study design with an established play@home region providing the intervention samples. The control samples were drawn from a region with comparable demographic characteristics that had no prior exposure to the play@home resource. As a result, at entry to the study the Baby groups in both regions were new to play@home and the Toddler Intervention group had been exposed to two (Baby and Toddler books) of the three sets of resource materials. The Pre-school Intervention group had similarly been in receipt of the play@home resource since birth and consequently had received all three sets of materials. The evaluation sought to explore the idea that those children who had received the three sets of play@home materials would have better outcomes than those who had not. There were two elements to the analysis. In the first, the research independently compared the primary and secondary outcome data generated from the Intervention and Control samples of the three age groups (Babies, Toddlers, Pre-school) at an initial observation timepoint (Babies 4-6 months, Toddlers 24-27 months, Pre-school 42-48 months of age). This baseline cross-sectional analysis was based on Intervention and Control region sample sizes of 87, 89, 55 and 79, 83, 52 parents/children for the Baby, Toddler and Pre-school groups respectively. The potential effects of the play@home intervention were then independently assessed in the Baby, Toddler and Pre-school groups longitudinally over periods of 10.4, 10 and 9.7 months respectively. The longitudinal analysis was based on sample sizes of 66, 63, 48 and 51, 61, 41 parents/children who completed the post-intervention assessments in each of the Baby, Toddler and Pre-school groups within the Intervention and Control areas respectively.

Summary of main results

Baseline Cross-sectional Observations revealed:

Baby group

- No differences were observed in any of the measurements for the Baby group between the Intervention and Control areas.

Toddler group

- Higher levels of Ages and Stages Questionnaire assessment scores were found in the Toddler Intervention group compared with the Toddler Control group. In

particular, statistically higher scores were observed for Gross Motor, Fine Motor and Problem Solving Ages and Stages Questionnaire sub-domains

- Higher scores were found on the Pleasure in Parenting Scale for the Toddler Intervention group with parents scoring significantly higher on three specific questions relating to “mealtime activity”, “tidying away toys”, and “parent-child errand activity”
- In addition, for the Toddler Intervention group alone, a statistically significant correlation was observed between selected sub-domains in the Ages and Stages Questionnaire assessment and the Pleasure in Parenting Scale: (i) Ages and Stages Questionnaire Gross Motor & Pleasure in Parenting Scale total ($r = 0.29$, $p = 0.007$) and (ii) Ages and Stages Questionnaire Personal Social & Pleasure in Parenting Scale total ($r = 0.25$, $p = 0.018$).

Pre-school group

- In the Pre-school group, no significant differences were observed in habitual physical activity levels between the Intervention and Control groups
- A statistically significant difference was observed for Ages and Stages Questionnaire assessment scores with the Pre-school Intervention group reporting higher scores for the Ages and Stages Questionnaire Fine Motor skill sub-domain. No significant differences were observed for Shared Activities Questionnaire responses.

Taken together, and with the caveat that these are cross-sectional observations, these data appear to indicate that the play@home resource was particularly associated with higher levels of development (as measured by the Ages and Stages Questionnaire) amongst the Toddler Intervention group. Exposure to the resource in the Toddler group also appears to be reflected in reports, by the primary carer, of higher levels of parent-child engagement. This conclusion is based, in part, on the absence of any differences at the time of initial receipt of the resource in the Baby group but the observed presence of such differences between areas at the Toddler stage.

Longitudinal Observations

Only one significantly better scoring outcome was identified in the play@home Intervention group compared to the Control group:

- At the end of the longitudinal observation period a significant effect was seen for percentage time spent in Moderate to Vigorous Physical Activity (percentage score; $p=0.035$) wherein the Intervention group was seen to improve more than the Control group over the evaluation period
- Pre-Post analysis of the longitudinal observation period data revealed Moderate to Vigorous Physical Activity percentage scores were observed to be significantly different with the Intervention group, characterised by a modest absolute increase in Moderate to Vigorous Physical Activity of 0.95%
- This increase in physical activity, for the intervention group alone, constituted a 28% relative increase in Moderate to Vigorous Physical Activity above baseline

values corresponding to a mean increase of 7.2 minutes per day in time engaged in Moderate to Vigorous Physical Activity.

If this observation were to be extrapolated to a one week period, the Intervention group would potentially accrue approximately 50 minutes extra Moderate to Vigorous Physical Activity per week in comparison with their baseline activity levels. None of the changes favoured the comparison site.

Exit Survey

Exit survey information obtained from almost 100 of the play@home Intervention group (~33% of the total intervention sample), revealed that well over two thirds of the sampled Baby (86%), Toddler (85%) and Pre-school (67%) participants, found the resource to be either 'Very Useful' or 'Useful'.

Discussion

The demographics of the samples recruited and the baseline data generated indicate that this was a broadly representative sample of Babies, Toddlers and Pre-school children in Scotland. The Ages and Stages Questionnaire, Body Mass Index (BMI) and Physical Activity data, in particular, closely approximated established normative data and/or published data generated from comparable age group samples. The preliminary baseline cross-sectional comparisons provided a "snapshot" of information that suggested that there may be a positive association between prior exposure to the play@home resource and Ages and Stages Questionnaire sub-domain scores for Toddlers and Pre-school Intervention groups. It may be also speculated that, for the Toddler Intervention group parents, a similar association might exist in regard to the Pleasure in Parenting Scale response data. It should be stressed that this is not a randomised controlled trial but the fact that the Toddler Intervention group, which had been exposed to two of the three play@home resource books, performed more highly than the Toddler Control group, who had never experienced play@home, provides support for the suggestion that this emerging difference may be associated with, if not necessarily attributable to, play@home. Although analysis of the post-intervention data set indicated a trend ($P=0.050$) towards the persistence of higher total Pleasure in Parenting Scale for the Toddler Intervention group, the more robust ANCOVA analysis did not reveal a statistically significant area effect. However, the cross-sectional baseline differences in favour of the Intervention area appear to reflect a higher degree of carer-child engagement generally but particularly in those tasks which one would conventionally describe as parental chores and not obviously play. In this instance one might again plausibly associate this difference with the Toddler Intervention group's exposure to the play@home resource. This is an important observation given the increasingly strong Scottish Governmental focus on the Early Years (0-3 years of age).

No statistically significant change in the total daily level of physical activity (includes all activity which is not classed as sedentary), as measured by average accelerometer counts per minute, was observed in the Pre-school Intervention group. However, a statistically significant effect was observed longitudinally for the Pre-school Intervention

group on Moderate to Vigorous Physical Activity behaviour (activity which leaves the individual feeling warm and slightly out of breath). The Pre-school Intervention group increased the measured percentage of time spent in Moderate to Vigorous Physical Activity. This appears to be a genuine, if modest, effect that may also be associated with exposure to the play@home intervention. It is noteworthy however, that even this increase in physical activity in the intervention group did not result in the achievement of the 60 minutes of MVPA per day recommended by the Scottish Government (Lets make Scotland more Active 2003). Our general observations about habitual levels of physical activity in the children sampled in this study appear to be entirely consistent with those reported elsewhere for similar samples of Scottish Pre-school-age children.

In conclusion, the play@home intervention, as administered in the present study, gives indicative evidence of positive outcomes, especially those related to motor skill, personal/social development and parenting in the early stages (Toddler group). The fact that the longitudinal observations did not reveal any additional differential gains in gross motor skills or parent-child interactive behaviour across the observation period is disappointing but does not detract from the strength of the baseline differences which appear to reflect the principal aims of the programme. Our finding that the children's fine motor skills were also ahead in the Pre-school Intervention group suggests a potentially very real benefit to be had in an area which is fundamental to school readiness. Pleasingly, given the original aims of the play@home programme, a modest but potentially important improvement was seen in moderate-to-vigorous-physical activity levels amongst the Pre-school Intervention group.

It is recognised that properly conducted, sufficiently intensive parenting interventions can work. Given the relative lack of control in this study, it is heartening to see the observations reported. Parents, especially those of the younger children, do seem to respond well to the play@home programme and it does appear to lead to some positive results.

1. Introduction

1.1 Background

The dramatic increase in childhood obesity in the past few decades (Reilly and Dorosty, 1999) is a particular Public Health concern for Scotland as it has been reported that 8.6% of Scottish three- to four-year-olds were obese (very overweight), exceeding the UK reference standard of 5% (Armstrong, Reilly, Child Health Information, 2003). In addition, many very young children are considered sedentary and therefore at increased risk of establishing an inactive lifestyle even before the age of school entry (Reilly et al, 2004). A recent report has also observed that mastery of fundamental movement skills (basic motor skills such as walking, running, jumping, catching and throwing and fine motor skills which generally refer to the smaller movements of the hands, wrists, fingers, feet, toes, lips etc) in modern children is low (Reilly et al, 2006). Moreover, scores on movement skills assessments may be negatively related to a higher body mass index in children aged 9-15 (Okely et al, 2004) and positively related to time spent in moderate and vigorous physical activity (MVPA) in 394 pre-schoolers with a mean age of 4.2 years (Fisher et al, 2005).

Although movement (howsoever defined) appears to be associated with the physical development of children and has the potential to link into national programmes geared towards reducing childhood obesity, this is clearly only part of the story. One could reasonably argue that programmes encouraging physical activity are important in raising expectations of what the child should and should not be doing (i.e. developing co-ordination skills and physical strength rather than remaining sedentary watching the television or playing computer games). Greater mastery of fundamental movement skills may also increase future participation in sport, and self efficacy (Okely and Booth, 2004). However, the exact nature and extent of these relationships are unclear at present (Fisher et al, 2005).

There is also evidence to suggest that early experience 'shapes' the human brain, and that through touch and verbal communication from parents, or primary caregivers, neural pathways are formed contributing to a child's normal cognitive development (Perry, 2002). It might therefore be equally, if not more useful, for Early Years interventions to support the development of meta-cognitive (thinking about thinking) and thinking skills as the acquisition of these skills is likely to improve a child's school readiness. This type of interventional focus may also indirectly influence a child's physical activity behaviours as the more alert and engaged a child becomes the more likely they may be to participate in classroom and other activities more generally

There is considerable evidence to suggest that the development of what are sometimes known as pre-literacy skills (vocabulary, interest and enjoyment of books, print awareness, narrative/storytelling skills, letter knowledge, and ability to hear and manipulate sounds) can have a real effect on the child's readiness to engage in the Pre-school and this then has a knock on effect of their experiences in the Pre-school (Goldfield et al, 2011; Whaley et al, 2011). It is important to acknowledge that such

effects may be lagged, with a change over a short but critical period feeding into other skills which in turn go on to affect the final outcome. For example in a recent analysis of the ALSPAC dataset (Roulstone et al, under review) in the West of England identified the communication environment of the home being more closely related to language development at two years than broader social risk measures. However, by school entry the influence of the communication environment had been replaced by language development as a predictor of performance. In short, any intervention designed to change behaviour in parents and children is almost by definition complex in the sense the term is used by the Medical Research Council (Craig et al, 2008). This is especially the case when the intervention is formulated in terms of materials but the administration is highly contextualised and the outcomes varied.

The National Physical Activity Task Force for Scotland set a strategic priority (SP51) “that parents should be given support to gain the necessary skills and confidence to take an active role in helping their children to enjoy an active life” (Scottish Physical Activity Task Force, 2003) and play@home is an example of just such a programme that promotes physical activity for children from birth. The aims of the programme originally were described as “to educate parents in safe, beneficial ways of handling and exercising their Babies and to encourage regular participation in physical activity by children”. The principal objectives of the scheme focused upon the enhancement of aspects of physical and psychosocial development by:

- promoting good movement patterns
- encouraging communication
- promoting physical activity in children
- strengthening parent/carer-child bonding through loving touch

The original play@home programme, developed for and by NHS Fife, has now been adopted and implemented in many other areas of Scotland. Information gathered from interviews with practitioners and parents about implementation and through process evaluations of play@home have been encouraging (Fee, 2006; Scott Porter, 2006). However, there are no published studies that have documented the impact of using the play@home, or any related programme (*KiwiBabies*, *Fit Ayrshire Babies*), on any longer-term outcome evaluation measures of physical activity, movement skills development, cognitive/communication development or parent-child bonding. This gap in the Early Years research evaluation literature is underscored by an emerging body of evidence that highlights the importance of the very early years in terms of optimal social, cognitive (Diamond et al, 2007; Ball, 1994) and physical development (Gabbard et al, 2008). Although there are examples of successful Early Years interventions in the USA (Schweinhart et al, 2005; Schweinhart & Weikhart, 1997; McKey et al, 1985) there is a lack of this kind of evaluative research evidence in the UK, and especially in Scotland. A previous evaluation concluded that it was not possible to assess the impact of play@home on measurable outcomes, due to ‘lack of accessible and reliable information.’ (Scott Porter, 2006). While the 2006 evaluation was generally positive in terms of feedback received from parents and professionals, it was evident that there

remained a need to objectively determine the impact of the scheme on measurable outcomes in families (children).

1.2 The play@home intervention

play@home is a three-book based play and physical activity programme for children from birth to five years, delivered in three stages: Baby (birth-1 year) Toddler (1-3 years) and Pre-school (3-5 years). The books are given to parents to encourage them to use the activities with their children, guiding and informing them on child development. The principal objectives of the scheme are to enhance aspects of physical activity and psychosocial development by promoting good movement patterns, encouraging communication, promoting physical activity and strengthening the parent-child bond through loving touch. The play@home programme is referenced in strategic point 110 of the Scottish Government's document 'Lets make Scotland more Active: A Strategy for Physical Activity' (2003), as an example of best practice.

The Baby Book: This is given to the parents of new babies by their Health Visitor usually at the primary visit to the home. The Baby Book provides a one page introduction about the benefits of the Baby exercise programme, and also provides a page of explanation on how to use the information provided by the book. General information is also provided about Baby behaviour and variability in anticipated rates of development. The activities found within the book are age and stage of development relevant. The Baby Book is split into four sections based on age, 0-3 months, 4-6 months, 7-9 months and 10-12 months. The activities include bathing and water play, loving touch and massage techniques, movement, communication, imagination and creativity and each activity is stated clearly with instructions, as well as the benefits provided by each activity.

The Toddler Book: This is given to parents around the time of the child's first birthday. In some areas it may have been posted to the child's home but in most areas it is given to parents at a clinic or home contact. The health visitor/public health nurse arranges the distribution of the Toddler Book. The book provides a brief overview of the 'importance of play@home' and lists the benefits that using the Toddler Book is expected to provide. A short section provides information to parents on how to use the play@home Toddler programme. Three pages of information are provided to give a general overview of Toddler development and play, social interaction and language development. As the Toddler Book requires the use of play materials, an eight page section is provided with information as to how to make these items. As with the Baby Book, the activities in the Toddler Book are separated into age specific sections; these are 12-18 months, 18-24 months, 24-30 months and 30-36 months. Each age specific section provides activities which are aimed at achieving the benefits stated in the Baby Book whilst introducing activities such as drawing and messy play. The potential benefits of each activity are described along with precautions which need to be taken into account when undertaking the activities.

The Pre-school Book: This is usually issued through school nurseries. Most children in Scotland are offered a place at nursery in their ante pre-school year and this provides

an opportunity to reach most three-year olds through one service provision so Pre-school Books are issued on enrolment at nursery. Unlike the Baby and Toddler books, the Pre-school book is not split into age specific activities, with all activities being suitable for the group. This book also provides a greater opportunity for shared activities as children of this age are learning to play together.

1.3 Aim

The aim of this evaluation, as outlined in the tender document, was to evaluate the effectiveness of play@home in meeting the stated programme outcomes (improved physical activity, motor skills, cognitive and social development and parent-child bonding). The research aim was addressed in two phases; cross-sectional baseline comparison and longitudinal comparison. Two independent evaluations of the effectiveness of play@home were carried out in each of the three target groups; Babies (recruited when at least 4 months old), Toddlers (recruited when at least 24 months old) and Pre-school children (recruited when at least 42 months old). This research approach was adopted to permit the exploration of (i) the potential for any pre-existing effect of prior play@home exposure in the Intervention group sample and (ii) the monitoring of any longitudinal changes in the Intervention group compared with the Control group. To maximise the recruitment and facilitate operational management of the intervention arm of the investigation, a non-randomised controlled, pre-post, design was implemented with an established play@home area providing the intervention samples.

1.4 Objectives

1. To conduct cross-sectional comparisons of play@home programme-related outcomes (improved physical activity, motor skills, cognitive and social development and parent-child bonding) between the Intervention group of children receiving play@home and the Control group of children not receiving play@home in each of the three designated age ranges:
 - a. 4-6 months (this age group chosen because greater likelihood of receipt of resource and also ASQ only applicable from 2 months+)
 - b. 24-27 months
 - c. 42-48 months
2. To conduct longitudinal comparisons of play@home programme-related outcomes (improved physical activity, motor skills, cognitive and social development and parent-child bonding) between groups of children receiving play@home and groups of children not receiving play@home in each of the three designated age ranges:
 - d. 4-6 to 14-16 months
 - e. 24-27 to 34-37 months
 - f. 42-48 to 52-58 months

3. To conduct a play@home resource-use exit interview with participants in each of the three age-group specific play@home Intervention groups in order to elicit information about the pattern of use of, and views about the play@home resource book.

Due to the established multi-dimensional aims of the play@home scheme and also the absence of a valid measure of physical activity in children younger than 3 years of age it was proposed that the effectiveness of play@home be assessed for the respective age-groups by using:

1. In the Baby and Toddler groups, the Ages and Stages Questionnaire (ASQ) as the primary outcome and the Pleasure in Parenting Scale (PPS) as a secondary outcome.

2. In the Pre-school group, accelerometer measurement of total daily physical activity (mean counts per minute) as the primary outcome (Physical Activity was Primary outcome – but this PA variable was not the variable upon which study was powered) and the ASQ and the Shared Activities Questionnaire (SAQ) as secondary outcomes.

2. Method

2.1 Research Design

The research study was conducted through three independent evaluations of the effectiveness of play@home with its three target groups: Babies, Toddlers and Pre-school children. To maximise the recruitment to, and facilitate operational management of, the evaluation consisted of a non-randomised, pre-post study design was implemented with an established play@home region (NHS Fife area) providing the Intervention samples. The Control samples were drawn from a region with comparable demographic characteristics (NHS Forth Valley area) that had no prior exposure to the play@home resource. As a result, at entry to the study the Baby groups in both regions had not previously been exposed to play@home and the Toddler Intervention group had been exposed to two of the three sets of resource materials (Baby and Toddler books). The Pre-school group had similarly been in receipt of the play@home resource since birth and consequently had received all three books. The evaluation sought to explore the idea that those children who had received all or some of the play@home materials would have better outcomes than those who had not. There were two elements to the evaluation research design. In the first, the research independently compared the primary and secondary outcome data generated from the Intervention and Control samples of the three age groups (Babies, Toddlers, Pre-school) at entry to the study. This cross-sectional analysis was based on Intervention and Control region sample sizes of 87, 89, 55 and 79, 83, 52 parents/children for the Baby, Toddler and Pre-school groups respectively. The effects of the play@home intervention were then independently assessed in the Baby, Toddler and Pre-school groups longitudinally over periods of 10.4, 10 and 9.7 months respectively. The longitudinal analysis was based on sample sizes of 66, 63, 48 and 51, 61, 41 parents/children who completed the post-intervention assessments in each of the Baby, Toddler and Pre-school groups within the Intervention and Control regions respectively.

Table 1 summarises the phases of assessment and outcome assessments used.

Table 1 Constituents of the Research Assessment

Pre-Assessment		Post-Assessment		Follow-up Assessment (Intervention Groups)	
	Administered		Administered		Administered
0-1 Baby		0-1 Baby		0-1 Baby	
ASQ (child)	Parent	ASQ	Parent	play@home resource use exit Questionnaire	Researcher Telephone Interview
PPS (parent)	Parent	PPS	Parent		
2-3 Toddler		2-3 Toddler		2-3 Toddler	
ASQ (child)	Parent	ASQ (child)	Parent	play@home resource use exit Questionnaire	Researcher Telephone Interview
PPS (parent)	Parent	PPS (parent)	Parent		
4-5 Pre-school		4-5 Pre-school		4-5 Pre-school	
Physical Activity (child)	Researcher	Physical Activity (child)	Researcher	play@home resource use exit Questionnaire	Researcher Telephone Interview
ASQ	Parent	ASQ	Parent		
Shared Activities Questionnaire (parent-child)	Parent	Shared Activities Questionnaire (parent-child)	Parent		

2.2 Sample construction and recruitment

The proposed sample sizes for the primary outcome measures in each age group, adjusted for attrition were as follows:

- Using ASQ as the primary outcome for the Baby and Toddler age groups, a final post-intervention sample size of 128 (64 per group) was required to detect a significant change in ASQ. Taking into account estimated attrition over the course of the study of approximately 15-20% and data loss to follow-up it was proposed to recruit approximately 100 participants per group at baseline.

- Using accelerometer assessment of total daily physical activity (mean counts per minute) as the primary outcome for the Pre-school group a final sample size of 110 (55 per group) was required to be able to detect a change of 100 counts per minute in total daily physical activity. Taking into account estimated attrition over the course of the study of approximately 15-20% and data loss to follow-up it was proposed to recruit approximately 70-80 participants per group at baseline.

The process of identifying potential participants and their subsequent recruitment within the intervention region was based around the location of nurseries deemed likely to yield adequate numbers of pre-school age children aged between 42-48 months. Based on their postcode, the nurseries for the intervention region were assigned a Scottish Index of Multiple Deprivation (SIMD) Quintile (with quintile 1 being the most deprived and 5 the least deprived; (Scottish Government, 2009) and were randomised within each quintile for selection order. The play@home database was used to obtain the names, addresses and associated postcodes of eligible children. The postcodes of the potentially eligible children were then used to match as closely as possible the postcodes of the selected nurseries, which would potentially ensure an even sampling across the 5 quintiles of the SIMD. The same method was used for the Baby and Toddler age groups. A similar process was implemented to recruit participants from the comparison Control region. We also used a modest incentivisation measure to attempt to promote increased participation, uptake, baseline response and decreased loss to follow-up by offering participants who completed all assessments at baseline and at follow-up, a £15 gift voucher that could be redeemed for children's clothing, toys, books etc.

2.2.1 Selection of Comparison Region

To allow for appropriate comparison with the intervention region, the control region had to be demographically similar and have had no prior exposure to the play@home resource. After consultation with the play@home evaluation project steering group, Forth Valley was deemed to provide the most suitable Control comparison with Intervention out of the remaining regions still to receive the resource.

2.2.2 Application for Ethical and Research & Development (R&D) Approval

The names and addresses of potential participants for both Intervention and Control regions were obtained from databases held by the NHS (play@home database, Intervention; Community Health Index, Control). In order to access this information, ethical approval was sought from the Intervention and Control Regions' Research Ethics Committees. Letters of support were also required from the respective Public Health Departments and the Department of Education for both Intervention and Control regions. Following a favourable opinion, an application was made centrally to the NHS Research Scotland Coordinating Centre for R&D approval, where a favourable opinion was also achieved.

2.2.3 Caldicott Guardian Approval

Prior to initiating the process of gaining access to the relevant databases, Caldicott Guardian approval was required in order to obtain the names, addresses, postcodes and dates of birth of potential participants for recruitment. Caldicott Guardian Approval for Control and for Intervention Regions was obtained on 21/8/09 and 16/9/09 respectively.

2.2.4 Recruitment process

For the Intervention Region, the play@home database was accessed to obtain the name, date of birth, address and postcode of potential participants. Inclusion criteria ensured that only those children who received all of the required preceding age appropriate play@home books were contacted. This impacted on the number of children available for recruitment in this region with the greatest effect seen in the Pre-school age group. For example, based on dates of birth for sampling, the number of children within the specified age range was 2486. Of those only 717 had personally received all three of the play@home books and were therefore eligible to be contacted to be invited to take part in the study. Demographic information for the Control region was obtained from the Community Health Index (CHI). Access to the CHI proved to be initially problematic as there was no established protocol to allow researchers access, despite the research team being in receipt of the appropriate Caldicott approval. The research team was finally granted access to the CHI on 29/11/09 by the Lead Data Protection Officer for the Control region.

Recruitment between the two regions was phased to allow matching of quintiles based on postcodes and also in part due to the delay caused in gaining access to the CHI. On average the response time between sending out a letter of invitation and receiving a signed consent form was between 3-4 weeks. This necessitated the recruitment taking place in several sweeps based on the success of the previous mail-shot (see Figures 1 and 2). Due to the finite nature of the eligible pool of potential participants, based on their age, combined with a poorer than expected response rate, the initial sample of eligible participants was quickly exhausted. This required secondary access to both the play@home database and the CHI, for the Baby and Toddler sample groups in order to obtain the details of more potential participants. Additional reminder letters had to be sent out to the Intervention region due to very low initial response rate. In total 2969 individual initial recruitment letters were sent across both regions for all age groups combined. This resulted in final numbers of 166 babies and 172 toddlers at baseline and 117 babies and 124 toddlers at follow up. Pre-school numbers were 107 at baseline and 98 at follow up. In addition 89 pre-school children returned accelerometer data for physical activity measures.

Figure 1 Participation according to stage of investigation and Region: Baby and Toddler Groups

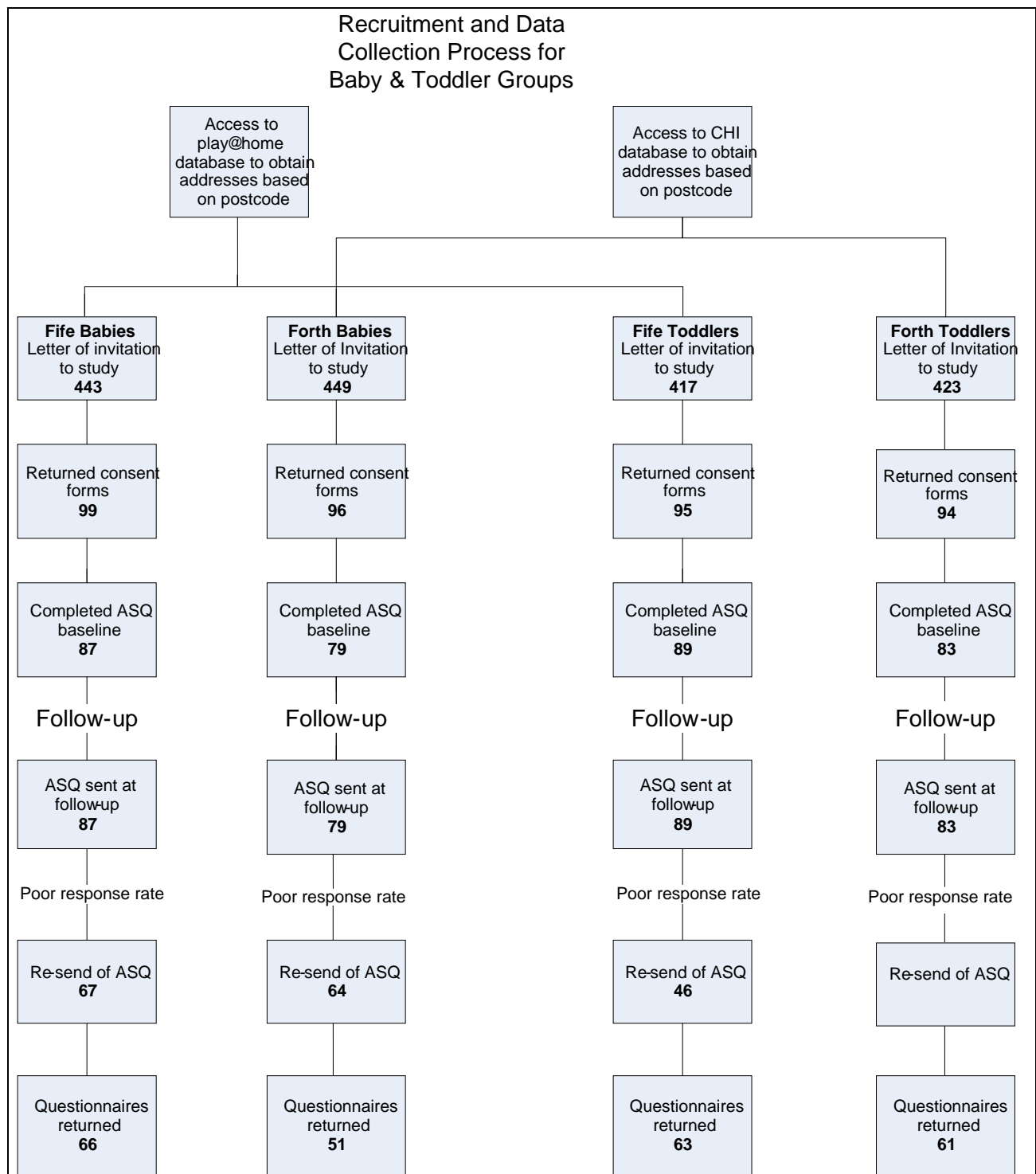
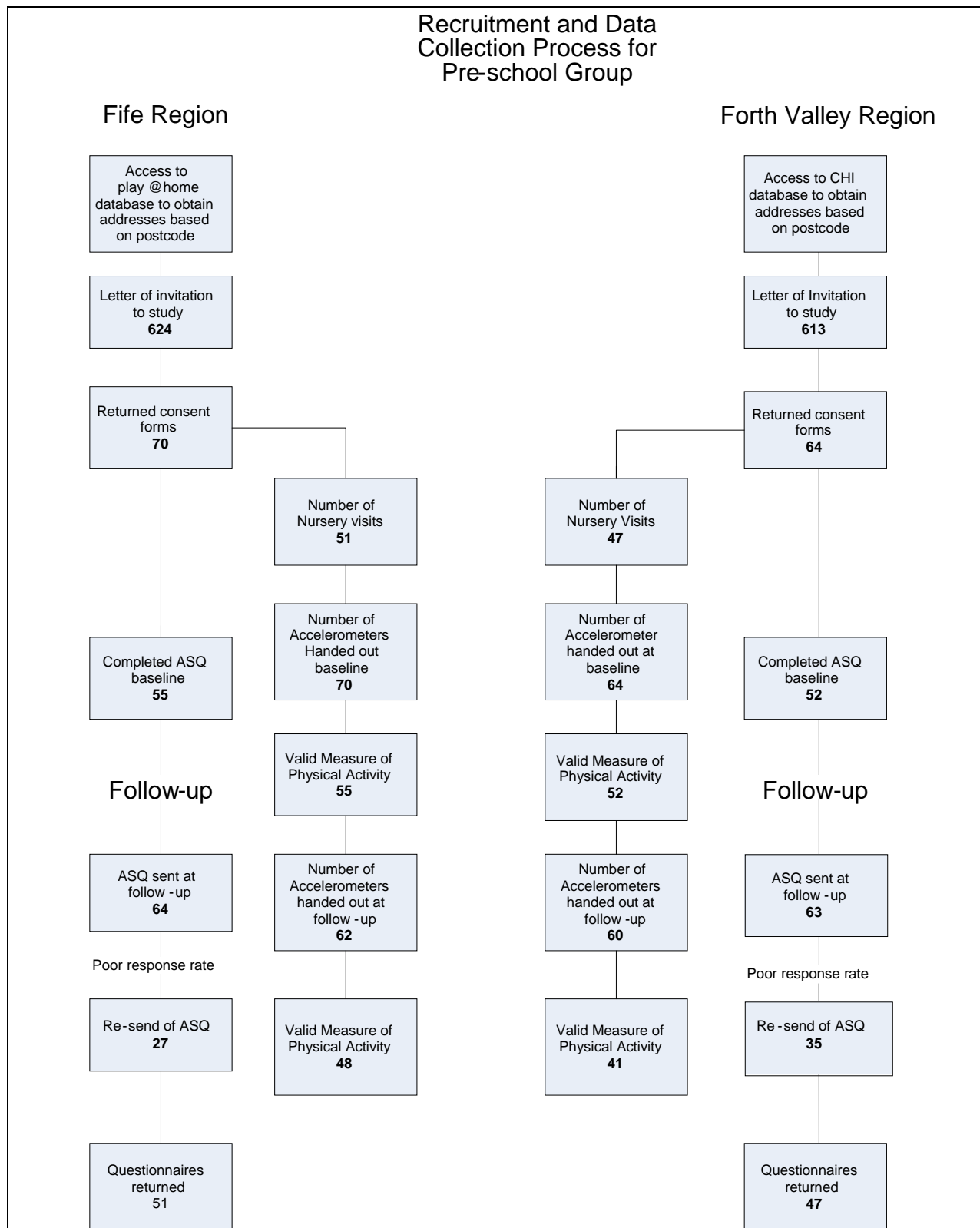


Figure 2 Participation according to stage of investigation and Region: Pre-school Group



2.2.5 Postal Contact

Each letter sent to a potential participant in the Intervention region was preceded by a letter of introduction to the study sent on behalf of the national play@home co-ordinator as requested by the Ethics Committee. Due largely to time constraints it was agreed, with the play@home evaluation steering group that for subsequent Control region recruitment, the letter of introduction from the national play@home co-ordinator would be included with the letter of invitation to participate in the evaluation. The total number of recruitment and baseline assessment letters sent (including consent forms and questionnaires) was 6812.

2.2.6 Nursery Visits for Pre-school Group

Nurseries were visited for the measurement of height/weight and Body Mass Index (BMI) and to distribute to and collect accelerometers from the Pre-school children. The vast majority of the nurseries sampled in both regions were local authority managed and were directly associated with the local State Primary Schools. Representatives from the Intervention and Control region Departments of Education had been requested to contact the nurseries in their area and inform them of the evaluation. A letter from the research team was also sent directly to the contact address for each nursery.

Due to the sampling procedure and the key Intervention region inclusion criterion, whereby a Pre-school child's carer had to have personally received all three play@home books, a much lower number of eligible potential respondents were identified for each nursery. This therefore required a greater number of nursery visits than initially anticipated as the majority of nurseries had only one potentially eligible child whose parent had consented for them to take part in the evaluation.

2.3 Procedure for data collection

2.3.1 Questionnaire Outcome assessments

All parent-administered questionnaires were scheduled to be posted to the families to arrive around 2 weeks before the appropriate Pre and Post Intervention assessment points (i.e. Babies, 2 weeks before the child is 2 months old and again 2 weeks before the Baby's 1st birthday; Toddlers, 2 weeks before 2nd birthday and 3rd birthdays; Pre-school 2 weeks before 4th and 5th birthdays) with the request that they were returned within 2 weeks. If questionnaires were not returned within allotted time, parents were reminded by a telephone call/email twice and if still not returned were offered telephone or possibly face-to-face assistance with completing the questionnaires.

2.3.2 Ages and Stages Questionnaire

The ASQ-version 3 (ASQ; Squires et al 2008/9) is a comprehensive, parent-report developmental screening measure for use with children from birth until 60 months of age (at 2 monthly age intervals). Each age-related questionnaire has 30 developmental items divided into five areas: communication, gross motor, fine motor, problem solving, and personal-social. Items are rated on a three-point scale indicating the child's ability

to complete the specified item (i.e., yes, sometimes, not yet; each category of response is then scored 10, 5, or 0 respectively). These ratings are converted to a point value, totalled and can be compared to established cut-off points to determine the presence or absence of developmental delay. The ASQ takes about 10–20 min to complete and has clearly written instructions (requiring a reading level equivalent to 11 years of age) that are supplemented by drawings to aid the parents' decision. Participants were asked to complete the ASQ within two weeks of receiving them by post. The age-sensitive nature of the ASQ meant that if a questionnaire was not completed within the prescribed time frame it became invalid. In a number of cases questionnaires were completed outwith the allotted time period. Where this occurred, the next age appropriate questionnaire was sent out for the parent to complete. When a questionnaire was not returned the same ASQ was re-sent for the parent to complete.

2.3.3 Pleasure in Parenting Scale

The PPS (Fagot, 1995) is a self-reported 10-item Likert-scaled response questionnaire measure of parent-child bonding. It has five response categories ranging from 1 (dislike) through to 5 (enjoy very much) for each of the 10 behaviours examined and is scored from a maximum of 50 points.

2.3.4 Shared Activities Questionnaire

The Shared Activities Questionnaire (Evangelou and Sylva K, 2003) was used to assess parent-child interactions in the Pre-school group. This parent-completed self-report questionnaire has three domains; activities parent/carer shares with their child, activities involving awareness of outside environment and activities that the child undertook in their own home. Parents/carers were asked to self-report how many times during the last month they undertook any of the listed activities with their child. Each question was scored from 1-5 with one denoting that the activity was undertaken seldom or never and five that the activity occurred on most days.

2.3.5 Physical Activity Outcome Assessment (via Accelerometer)

Habitual physical activity was assessed throughout the study using a GT1M Actigraph accelerometer. The GT1M is a small (3.8 x 3.7 x 1.8 cm), lightweight (27g), uni-axial accelerometer which measures time-varying accelerations in the vertical plane. It has been used widely in a number of studies evaluating physical activity in pre-school children (Hannon & Brown, 2008; Williams et al, 2008). This frequency range has been selected to detect normal human motion, allowing it to filter out any motion that has occurred from extraneous sources, such as mechanical transport (Actigraph 2009).

Accelerometers along with an information pack were given to parents either directly or through contact with the nursery. The parents were also provided with an information sheet reminding them to fit the accelerometer on their child once they were dressed in the morning and to take it off only when they went to bed, were bathed or went swimming. The children were expected to wear the accelerometers for 7 consecutive days to account for any potential differences between weekday and weekend days and for more than 10 hours each day as this has been shown to maximise the reliability of

total activity counts between days (Penpraze et al 2006). Once they had been worn for seven days they were returned to the nursery for collection. In a number of cases the children either refused to wear the accelerometers or only wore them for one or two days. The accelerometers were set to monitor activity in 15 second sampling intervals (epochs). This data sampling interval (15 second epochs) was chosen to take into account the pattern of Pre-school children's physical activity which by nature is characterised by low activity interspersed with short bursts of higher intensity and would allow for a more accurate reflection of the children's time spent in MVPA (Cliff et al 2009).

To address the potential effect of seasonality, physical activity data collection was phased (Start-finish; Winter-Autumn, Spring- Winter; Summer- Winter) in order to ensure "matched" patterns of recruitment and observation periods across Intervention and Control regions.

2.3.6 Exit Survey

A brief exit survey of participants in the play@home Intervention region was conducted to elicit information about the pattern of use of, and views about the play@home resource book. This was administered to sub-samples of at least 33% of the total number of participants recruited to the Baby, Toddler and Pre-school groups in the play@home Intervention region. This survey was administered either by telephone or email and took approximately 10 minutes to complete.

3. Results

3.1 Organisation of main research findings

This section of the report details the main findings of the research and is divided into four main sub-sections (3.2-3.5). The report of the main research findings begins with the description, in sub-section 3.2, of the number and demographic characteristics of the participants in each of the three age-group (Babies, Toddlers, Pre-school) samples according to the region of recruitment (Table 2 and table 3). Using a cross-sectional analyses sub-section 3.3 denotes any potential influence of area (and thus implicitly the possible effects of prior exposure to the play@home intervention) on the baseline characteristics of the children and parent child interactions, for each of the three age-group samples. Section 3.4 summarises the potential effects of region, and thus short-term longitudinal exposure to the play@home intervention on the study's primary and secondary outcome measures. The final sub-section (3.5) presents the findings of the Exit Survey, administered to sub-samples of the Intervention Baby, Toddler and Pre-school age groups, relating to the use of the play@home resource.

3.2 Recruitment, participation and sample demographics

Table 2 below shows a breakdown of the number of Babies, Toddlers and Pre-school children from each of the regions recruited to the evaluation and the number of invitations and consent forms returned. What is clearly noticeable is the poorer response rate from the Pre-school groups given the much larger number of invitations to participate that were sent out.

Table 2 Participant numbers and associated recruitment response rates: By region and by age-group

Group	Letter of Invitation	Reminder Letter	Returned Consent	Response Rate%
Babies Intervention	443	346	99	22.3
Babies Control	449	289	96	21.3
Toddlers Intervention	417	383	95	22.7
Toddlers Control	423	301	94	22.2
Pre-school Intervention	624	211	70	11.2
Pre-school Control	613	251	64	10.4
Total	2969	1781	518	17.4

Table 3 below shows the spread of participant response rates (%) according to age group and quintile of Scottish Index of Multiple Deprivation (SIMD). This data indicates that the Control and Intervention Baby groups had similar proportions at the lower end of the demographic distribution both with 49.4% in quintiles 1 and 2 together. The comparable figures for Toddler (30.5% and 33.4%) and Pre-school groups (42.3% and 35%) suggest that the Intervention Toddlers may have been slightly less disadvantaged than their Control counterparts whereas the difference was more marked and in the opposite direction for the Pre-school group. At the upper end of the distribution the difference for the Babies was 33.1% and 38.8%, for the Toddlers 49.3% and 46.6% and the pre-schoolers 33.1% and 38.6%. Overall then the Babies appear to be rather more disadvantaged than the other groups and the Toddlers more advantaged than the other two groups.

Table 3 Age of sample groups recruited and participant response rate (%): by region, age-group and SIMD Quintile

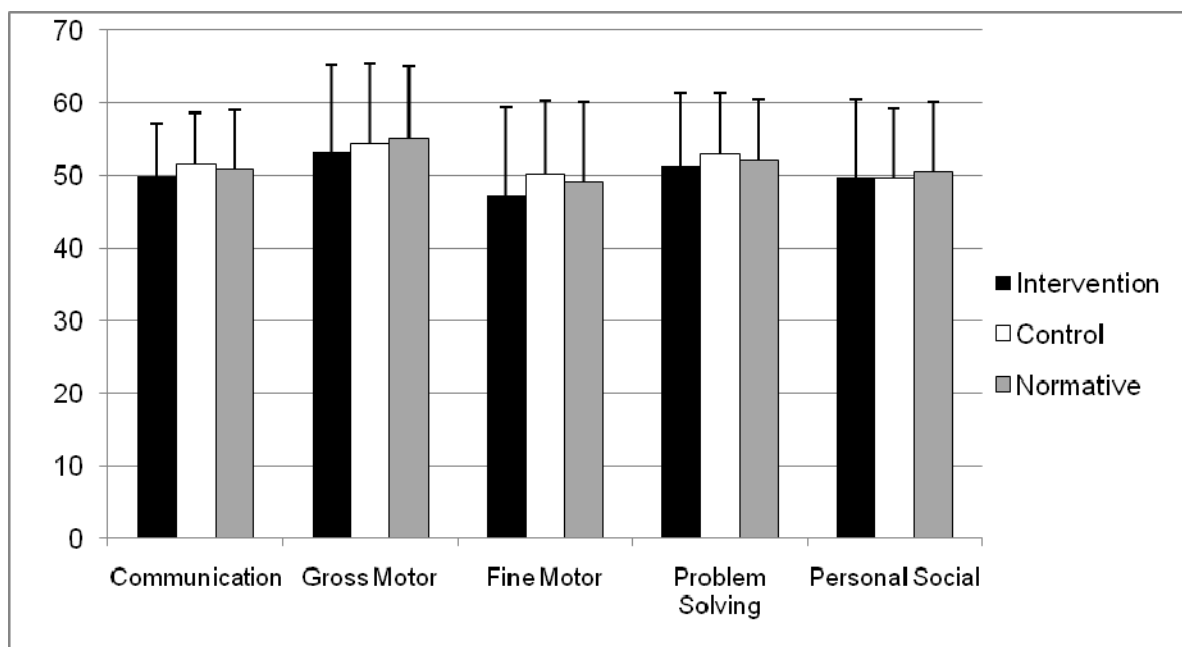
Group	Age (months) (mean \pm sd)	BMI (mean \pm sd)	Sample size	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Babies Intervention	4.98 \pm 0.99	-	99	20.6	28.8	17.5	10.5	22.6
Babies Control	4.99 \pm 1.01	-	96	19.6	29.8	11.8	23.3	15.5
Toddlers Intervention	25.24 \pm 1.46	-	95	14.7	15.8	20.2	25.8	23.5
Toddlers Control	25.19 \pm 1.47	-	94	12.3	21.1	20	22.2	24.4
Pre-school Intervention	43.43 \pm 2.58	16.51 \pm 1.61	70	19	23.3	24.6	13.9	19.2
Pre-school Control	44.0 \pm 2.85	16.75 \pm 1.41	64	14	21	26.4	19.3	19.3

3.3 Baseline cross-sectional observations

3.3.1 Baby Group (4-6 month)

Baseline ASQ responses for Baby Intervention and Control areas are presented in Figure 3 below. Non-parametric statistical analysis indicated that no significant differences existed between Intervention and Control groups for any of the five ASQ domains. Similarly, Figure 5 illustrates the absence of any significant differences in the Pleasure in Parenting Scale scores of the Intervention and Control regions at baseline for the Baby group only, but a significant difference for Toddlers with the Intervention group scoring higher.

Figure 3 Baseline ASQ Domain responses for Baby Group: by region (Each domain scored out of 60; Mean \pm sd)



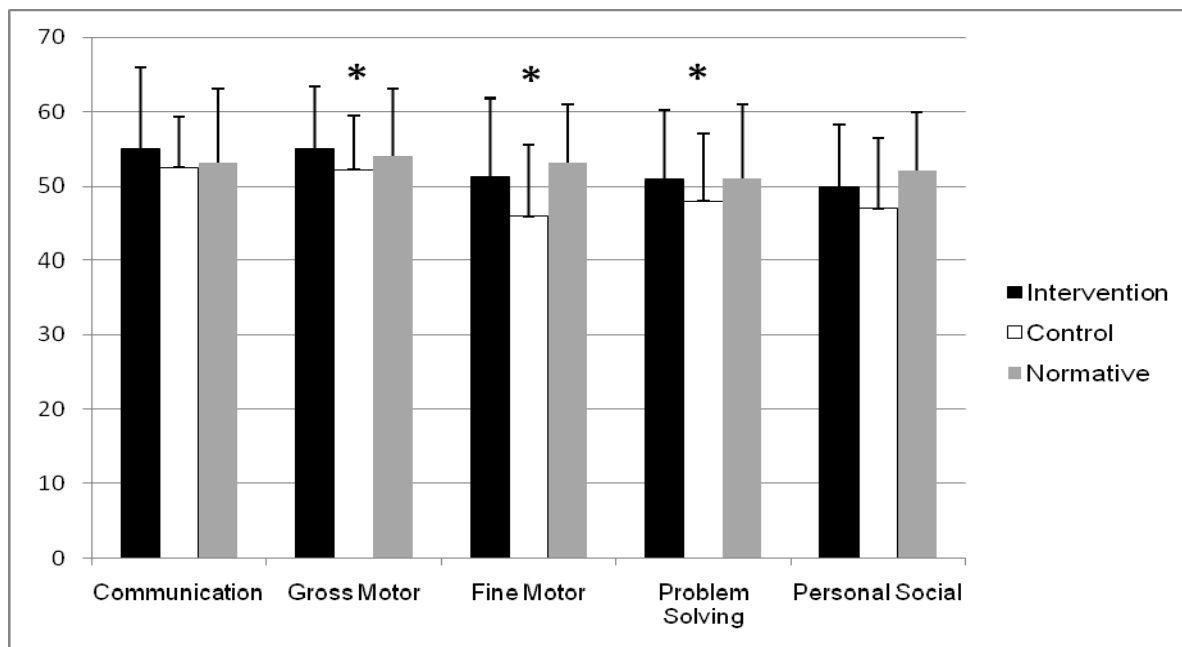
3.3.2 Toddler Group (24-27 Month)

Figure 4 illustrates the baseline mean data for each of the five ASQ Domains for the Intervention and Control Toddler groups in comparison with the published normative data. All ASQ sub-domain data, for both regions, fell comfortably within the normative ranges published for other post-industrial societies (USA and Norway). Non parametric analysis found statistically significant differences between the regions in 3 of the 5 ASQ domains, with greater scores being observed in the Intervention Region for Gross Motor ($p= 0.006$), Fine Motor ($p< 0.000$), and Problem Solving ($p= 0.048$). No significant

differences were found between the Intervention and Control sample responses for the communication or personal/social domains of the ASQ.

The age-group (Baby and Toddler) and region-specific variation in the mean overall score for the Pleasure in Parenting Scale responses is depicted in Figure 5. Non-parametric statistical analysis revealed a significant difference in the total PPS score with significantly higher ($p=0.03$) values observed in the Intervention Toddler group in comparison with the Control Toddler group. Exploratory non-parametric post-hoc analysis of these data highlighted significant differences between 3 of the 10 individual sub-items within the PPS questionnaire and these are summarised in Table 4 below.

Figure 4 Baseline ASQ responses for Toddler Group: by ASQ Domain and Region (Each domain scored out of 60, Mean \pm sd)

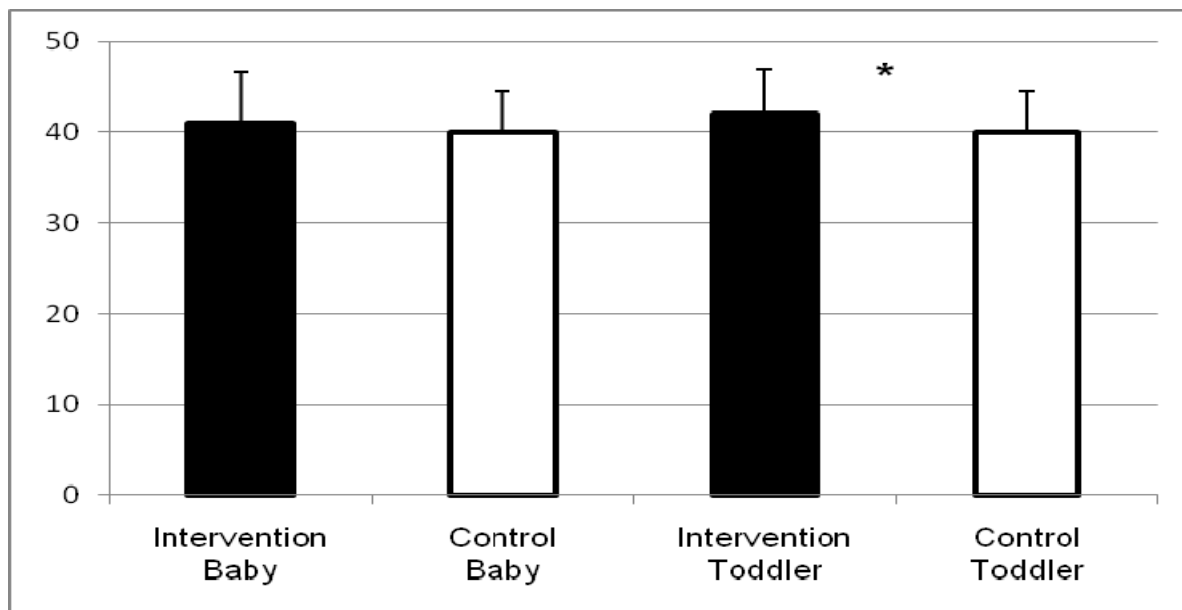


*Denotes significant difference with Intervention > Control; $P < 0.05$

Table 4 Inter-regional differences in Toddler group PPS sub-item scores at baseline

	INTERVENTION	CONTROL	P
Total PPS Score	42.1 (4.8)	40 (4.6)	0.03
Taking my child on errands	4.2 (.85)	3.5 (1.1)	0.001
Picking up my child's toys	3.3 (.90)	2.9 (1.0)	0.002
Helping child at mealtimes	4.22 (.84)	3.9 (.81)	0.016
Helping child go to the toilet	3.9 (.87)	3.6 (.82)	0.053

Figure 5 Total Pleasure in Parenting Scale responses at baseline for Intervention and Control Baby and Toddler groups (Mean \pm sd; * denotes significant difference)



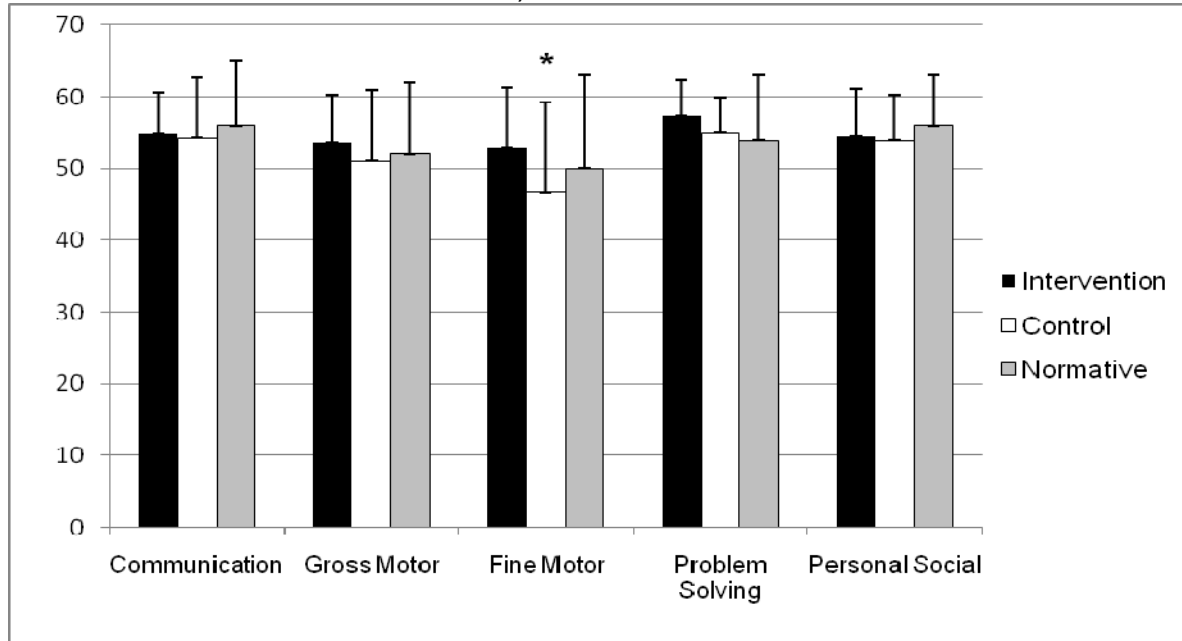
*Denotes significant difference with Intervention > Control; $P < 0.05$

Exploratory non-parametric correlation analyses also revealed weak, but statistically significant correlations between selected sub-domains of the ASQ assessment and the total PPS score: (i) ASQ Gross Motor & PPS total ($r = 0.29$, $p = 0.007$) and (ii) ASQ Personal Social & PPS total ($r = 0.25$, $p = 0.018$). These relationships were only evident for the Toddler Intervention sample.

3.3.3 Pre-school Group (42-48 Month)

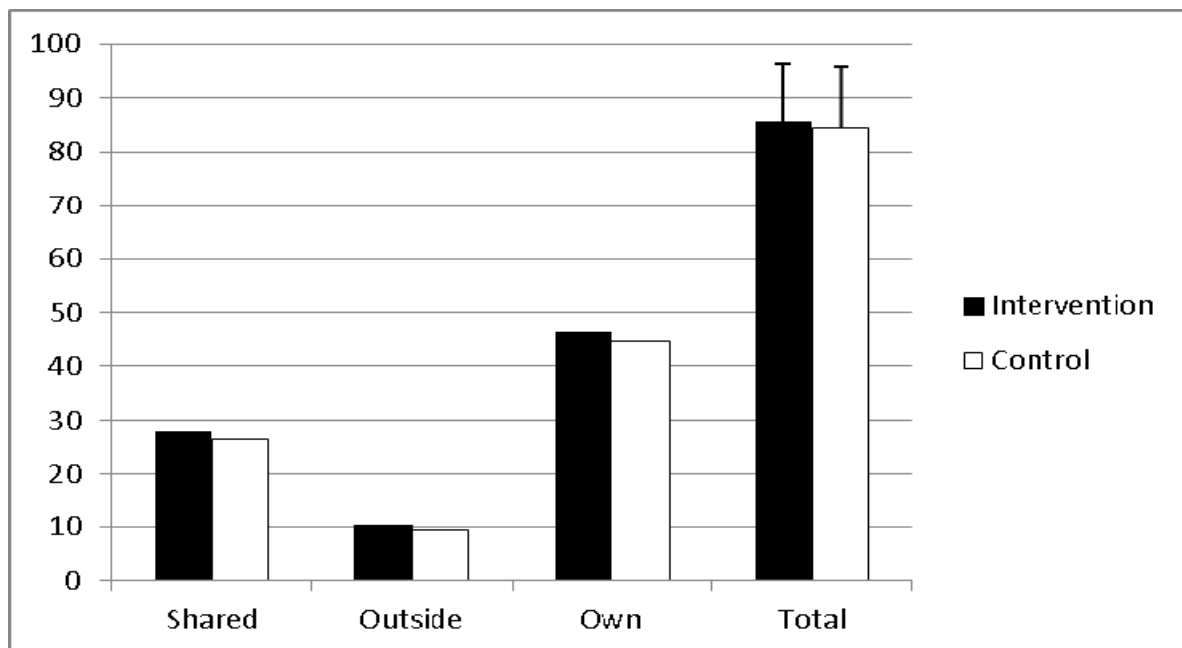
Figure 6 illustrates the baseline mean ASQ sub-domain responses for the Intervention and Control Pre-school samples in relation to published normative data. All ASQ sub-domain data, for both regions, fell comfortably within the normative ranges published for other post-industrial societies (USA and Norway). Non parametric statistical analysis of the influence of region revealed significant differences for the ASQ Fine Motor domain alone, with the Intervention sample scoring higher than the Control sample ($p = 0.002$). Statistical analysis revealed no significant differences in any of the three elements of the SAQ, or total SAQ responses between the Intervention and Control regions (Figure 7)

Figure 6 Baseline ASQ Domain responses for Pre-school Group: by Region (Each domain scored out of 60; Mean \pm sd)



*Denotes significant difference with Intervention > Control; $P < 0.05$

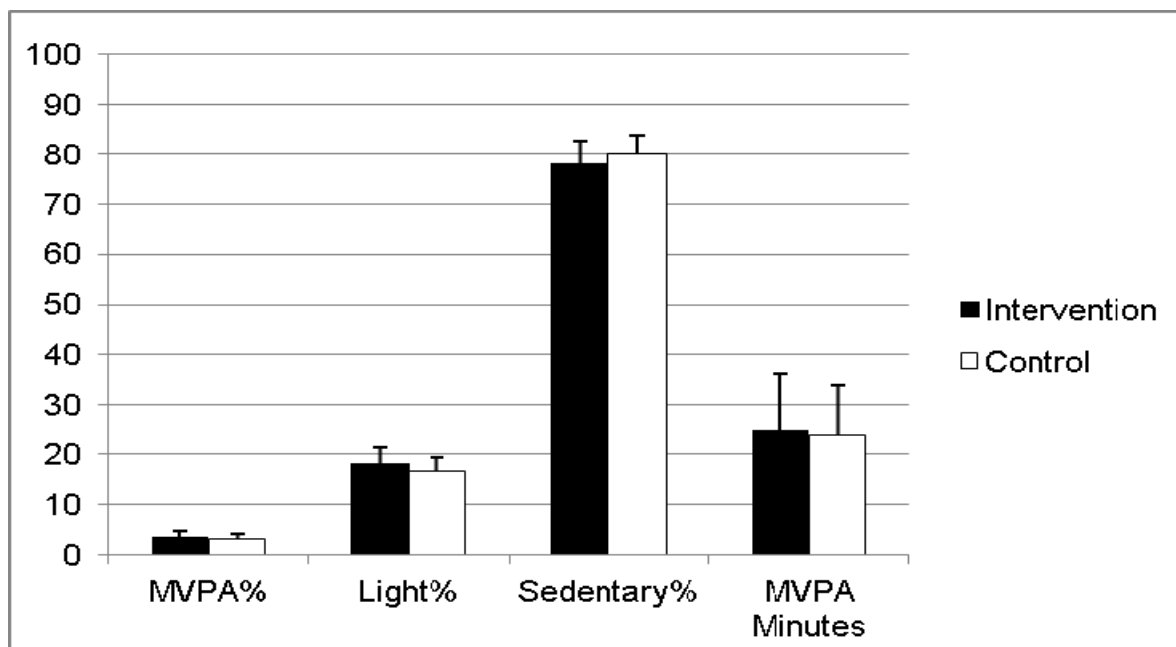
Figure 7 Baseline Shared Activities Questionnaire responses of Pre-school groups: Intervention and Control regions (Mean \pm sd).



3.3.4 Physical Activity assessment

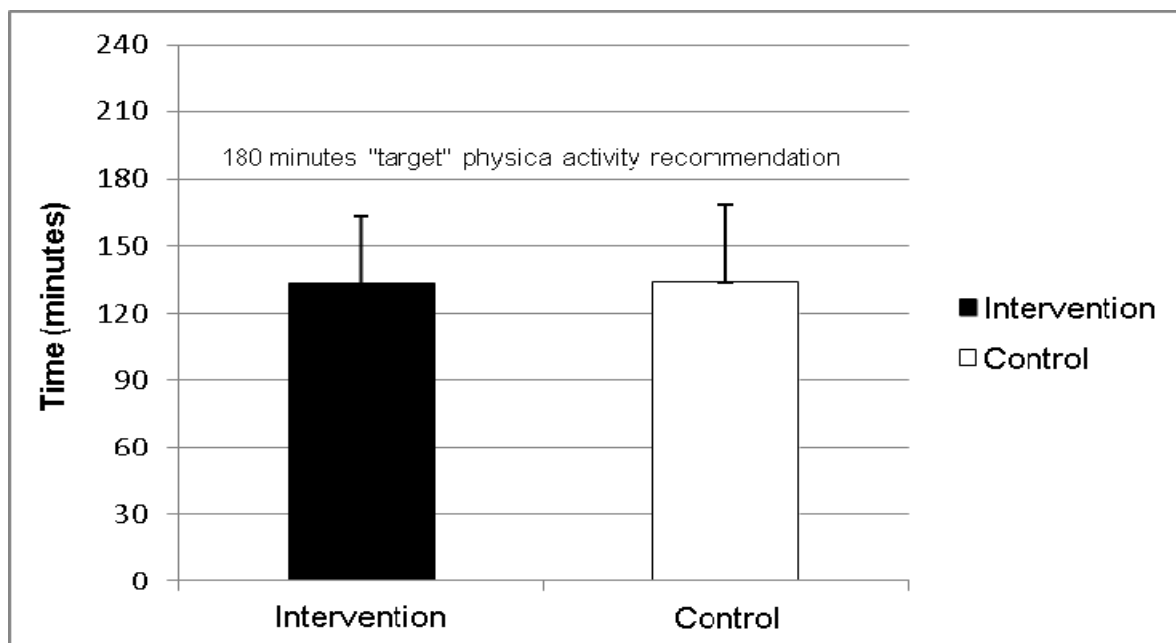
As anticipated, significant differences were observed between boys and girls in relation to observed physical activity behaviour with boys characterised as being more active in relation to total daily physical activity, expressed as averaged daily counts per minute (cpm) of total wear time (705.4 ± 208.7 cpm versus 617.6 ± 229 cpm). However, this wholly expected observation was accounted for in our sample design whereby broadly equivalent numbers of boys and girls were recruited across both regions at baseline (Intervention, boys = 53%, girls = 47%; Control, boys = 52%, girls = 48%) allowing inter-region comparison of physical activity levels based on the combined sample. Prior to constituting the combined sample it was also established that no inter-regional differences existed in physical activity levels for the sub-samples of boys and girls. Unsurprisingly therefore, we observed no significant differences between regions, at baseline, in terms of the primary physical activity outcome measure (total physical activity as characterised by averaged daily accelerometer counts per minute) with values of 667.1 ± 197 cpm and 676.1 ± 207 cpm for the Intervention (n=57) and Control (n=52) region samples respectively. The physical activity data is also shown as a mean percentage of the child's waking hours. Percentage of the day spent classified as engaged either sedentary, light activity, or MVPA behaviour is presented in Figure 8. No significant differences were observed between the two regions in relation to the percentage of total wear time observed for any category of behaviour. It can be seen from Figure 8 that, on average, these Pre-school children typically spent almost 80% percent of their waking day engaged in sedentary behaviour which is consistent with previously published data on Scottish Pre-school children.

Figure 8 Pre-school group Physical Activity levels at baseline by region (measured by accelerometer; % of total wear time and time in minutes spent in MVPA; Mean \pm sd)



Also shown is MVPA (in the pair of bars at the far right of the x-axis) as the total number of minutes (MVPA minutes) per day spent at this activity level to allow comparison with the Scottish Government's recommendation of at least 60 minutes of MVPA per day. As clearly highlighted in Figure 8, neither the Intervention nor Control groups of children even approached this Scottish Government target recommendation. Figure 9 further contextualises the prevailing physical activity behaviour of these Pre-school children by illustrating the median levels of total physical activity, achieved in both of the sample regions. This data indicates a failure even to achieve the more generous threshold recommendation that children of this age should accumulate at least 180 minutes of daily physical activity (of any intensity).

Figure 9 Total time engaged in any physical activity by Pre-school groups (accumulated daily time in minutes (Mean \pm sd)



3.4 Longitudinal Observations

3.4.1 Study participation at Follow-up

Tables 5, 6 and 7 below describe the ages of the respective sample groups and participant response rates by region at follow up assessment for the questionnaires. Table 8 shows the number of Pre-school participants recruited to the accelerometer assessment. The observed participant response rates translated into participant retention levels of 72%, 69%, 82% and 58%, 64% and 77% for Intervention and Control Baby, Toddler, and Pre-school groups respectively. It is noteworthy that a particularly poor response rate was received from the Control Baby sample.

Table 5 Age and number of Baby group participants completing questionnaire (ASQ & PPS) re-assessments at follow-up: by region.

Region	Age (months) (mean \pm sd)	Questionnaires sent	Questionnaires re-sent	Questionnaires returned
Intervention	15.38 \pm 1.14	87	67	66
Control	15.51 \pm 1.04	79	64	51

Table 6 Age and number of Toddler group participants completing questionnaire (ASQ & PPS) re-assessments at follow-up: by Region

Region	Age (months) (mean \pm sd)	Questionnaires sent	Questionnaires re-sent	Questionnaires returned
Intervention	35.19 \pm 1.34	89	46	63
Control	35.21 \pm 1.31	83	53	61

Table 7 Age and number of Pre-school group participants completing questionnaire (ASQ & SAQ) re-assessments at follow-up: by Region

Region	Age (months) (mean \pm sd)	Questionnaires sent	Questionnaires re-sent	Questionnaires returned
Intervention	53.5 \pm 1.70	64	27	51
Control	53.21 \pm 2.0	63	35	47

Table 8 Number of Pre-school group participants completing accelerometer re-assessment of physical activity: by Region

Region	Number Distributed	Re-wear	Number ≥ 3 days	Number < 3 days	Not worn	Data recording error	Unit not returned
Intervention	62	4	51	2	4	2	3
Control	60	7	46	2	6	2	9

Table 9 below shows the spread of participant response rates (%) according to age group and quintile of SIMD at follow up (see also Table 2 for comparison at baseline). The levels and pattern of participant response are very similar to those seen at baseline.

Table 9 Age of sample groups retained at follow-up and participant response rate (%): by Region, age-group and SIMD Quintile

Group	Age (months) (mean \pm sd)	BMI (mean \pm sd)	Sample size	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Babies Intervention	15.03 \pm 0.35	-	66	18.2	25.8	16.7	12.1	27.3
Babies Control	14.7 \pm 1.46	-	51	21.6	21.6	15.7	19.6	21.6
Toddlers Intervention	35.24 \pm 1.3	-	63	11.1	19.0	19.0	23.8	27.0
Toddlers Control	34.5 \pm 1.3	-	61	8.2	16.4	23.0	27.9	24.6
Pre-school Intervention	53.1 \pm 2.1	16.4 \pm 1.9	48	20.8	25.0	20.8	14.6	18.8
Pre-school Control	53.6 \pm 1.5	16.7 \pm 1.4	45	11.1	22.2	22.2	17.8	26.7

3.4.2 Missing data

Possible bias due to non-availability of follow-up data was investigated by coding these data as present or not within each group and then comparing these for differences with the appropriate parametric or non-parametric tests, on baseline demographics and

outcomes, both overall and within regions. Although no significant differences were observed with regard to the Intervention group, these analyses showed some differences for those returned and those who did not at baseline within the Control group. Specifically, within the Baby group, the ASQ domains of Gross Motor and Personal/Social were associated with those not completing follow-up (post-intervention assessment) having poorer scores at baseline. In the Toddler group, the baseline ASQ domain scores for Communication, Fine Motor, Personal/Social were observed to be higher in those not completing follow-up (post-intervention) assessments. The Pre-school ASQ domain of Personal/Social was associated with those not completing follow-up assessment having lower scores at baseline. Despite the identification of these differences in certain ASQ sub-domains it was evident that there was no systematic trend in these observations. As a result we suggest that data lost to follow-up did not markedly affect the interpretation of the remaining data and conclusions subsequently drawn.

3.4.3 Effect of the Longitudinal Intervention

Longitudinal data was analysed for each age-group separately to establish whether any significant region effect was evident between the play@home Intervention and Control groups across the intervention period. Where appropriate, analysis of covariance analyses (ANCOVA) were conducted on all post-intervention outcome assessment data using "region" as the independent, between-subject factor and pretest scores as the covariate.

No significant differences were recorded, over the longitudinal observation period, for the primary physical activity outcome variable of total daily counts per minute (see Table 9 below). However a significant difference involving post-intervention physical activity outcome assessment comparisons was identified. This was observed between the Pre-school groups for the secondary outcome of percentage total daily accelerometer wear time spent in moderate-to-vigorous physical activity (%MVPA). This was reflected in the comparison of post-intervention assessment data which revealed that the Intervention group exhibited a significantly greater percentage time spent in MVPA ($p=0.035$) compared with the Control comparison group. The region coefficient denoted in Table 10 is the estimated difference between the two regions. In effect the analysis of covariance adjusts each child's follow up score for his or her baseline score, but has the advantage of being unaffected by baseline differences. So, here the coefficient for region is interpreted as the difference between the mean change of each region. MVPA % increased by an estimated 0.67% more on average in the Intervention region than in the Control region.

For the Intervention region, this corresponded to a relative increase in daily MVPA of 28% compared with the baseline level (equivalent to the more modest absolute post-intervention increase of 0.95% in time spent engaged in MVPA). This in turn translated into an average increase of 7.2 minutes per day in time engaged in MVPA which, if

extrapolated across an entire one-week period would constitute approximately 50 minutes of additional MVPA. Figure 10 illustrates the lack of significant change in total daily physical activity between the regions and for assessment time points within a region. These data highlight the continued failure of this group of children to achieve the recommended threshold levels of accumulated physical activity during the intervention period. Although a significant difference was found in post-intervention levels of %MVPA between regions with the Intervention group exhibiting slightly higher levels of this activity behaviour, the overall effect on total daily physical activity was diluted somewhat by the lack of any meaningful change in the amount of light activity recorded.

Table 9 Physical activity levels recorded for all participants for whom pre- and post longitudinal observation period data was obtained (Mean \pm sd)

	Intervention (n= 48)		Control (n =41)	
	Pre	Post	Pre	Post
Total Daily Physical activity (mean accelerometer counts/ minute)	675.1 \pm 157	718.4 \pm 169	665.7 \pm 207	674.3 \pm 174
MVPA (% time)	3.48 \pm 1.37	4.43 \pm 1.74	3.40 \pm 1.88	3.57 \pm 1.42
Light activity (% time)	16.72 \pm 3.16	17.21 \pm 3.67	16.67 \pm 3.38	16.13 \pm 2.86
Sedentary (% time)	79.80 \pm 4.76	78.35 \pm 5.05	79.9 \pm 4.80	80.3 \pm 3.91

Table 10 Advantage of the Intervention group at Follow-up: ANCOVA

	B (95%CI)	Std. Error	Sig.
Constant	1.98 (1.01, 2.94)	0.67	0.000
MVPA % baseline	0.72 (0.46, 0.97)	0.13	0.000
Region	-0.67 (-1.28,-0.05)	0.31	0.035

3.5 Exit Survey

A brief telephone/email exit survey was conducted on a subsample of participants from each of the Intervention Baby (n=37), Intervention Toddler (n=31) and Intervention Pre-school (n=29) groups to explore their pattern of use of the play@home resource books and also to determine their view of the resource. Figures 10-16 present graphical summaries of the responses to the survey questions.

Figure 10 Comparison of age-group specific responses to the question: “How often did you use the play@home book?”

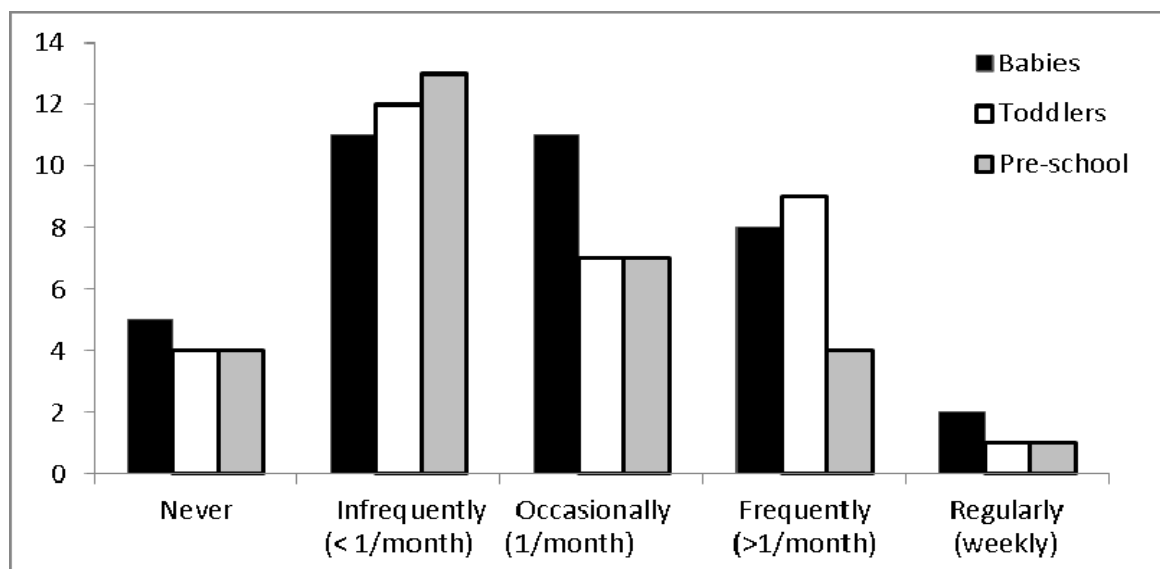


Figure 10, above, revealed that 43%, 48% and 59% of Baby, Toddler and Pre-school group respondents “never” or only “infrequently” used the play@home resource in contrast with 27%, 30% and 21% of the respondents who indicated that they used it “frequently” or “regularly”.

Figure 11 Comparison of age-group specific responses to the question: “Where was the play@home book mainly used?”

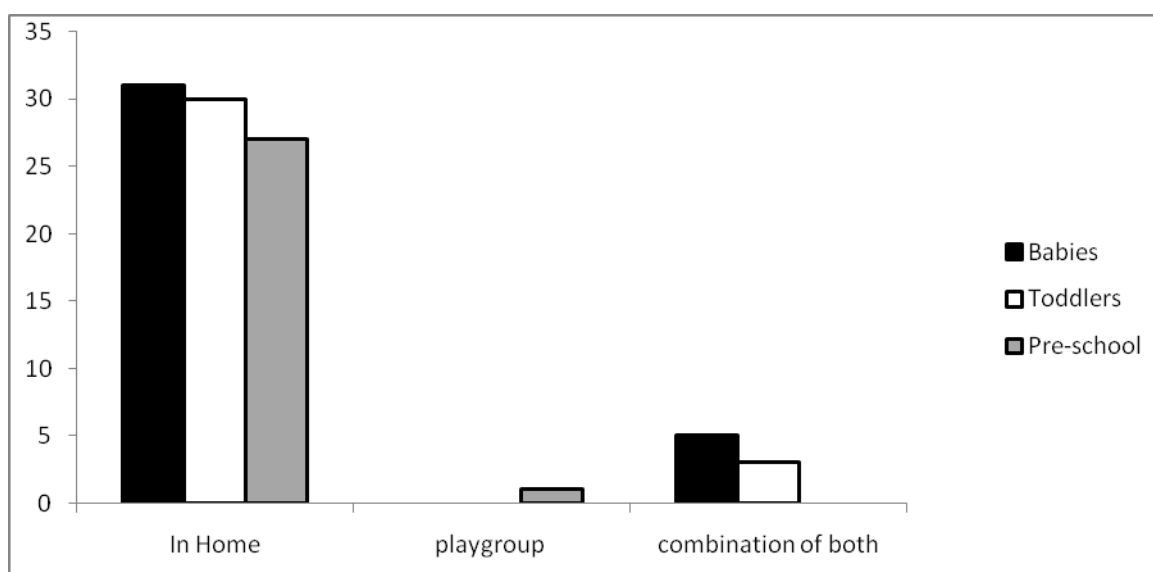


Figure 11 indicates that the vast majority of respondents indicated that they mainly used the books in the home rather than in a playgroup.

Figure 12 Comparison of age-group specific responses to the question: “How did you use the play@home book?”

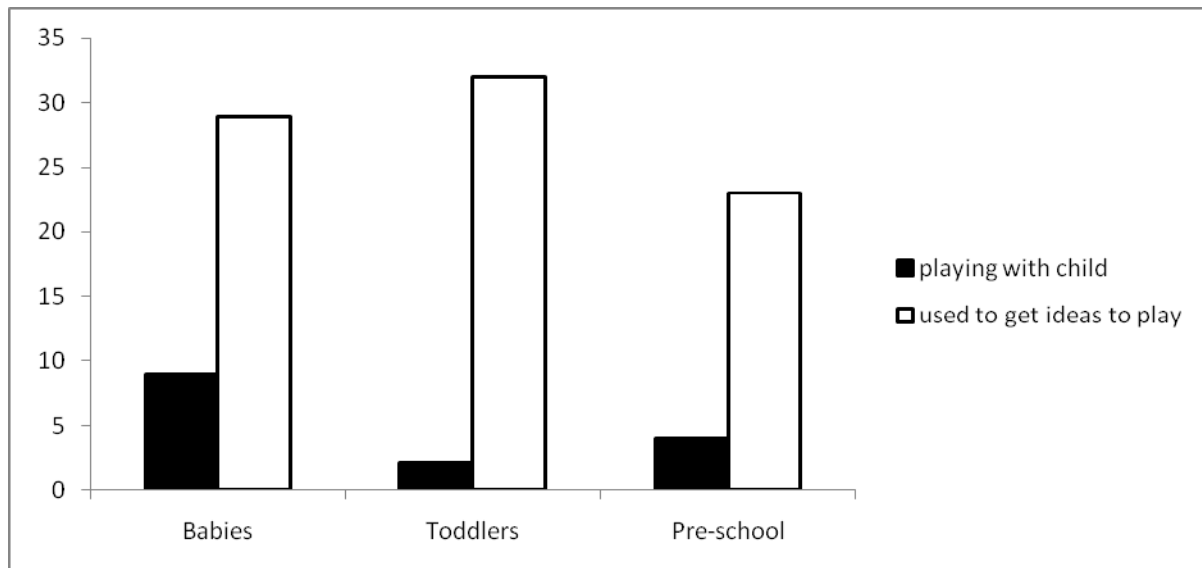


Figure 12 indicates that the vast majority of those sampled (Baby 78%, Toddler 94% and Pre-school 85%) used the book as a resource to aid the planning of play with their child with almost 100% of all three age groups responding that the resource was “easy-to-very easy to use” (Figure 13).

Figure 13 Comparison of age-group specific responses to the question: “How easy did you find the play@home book to use?”

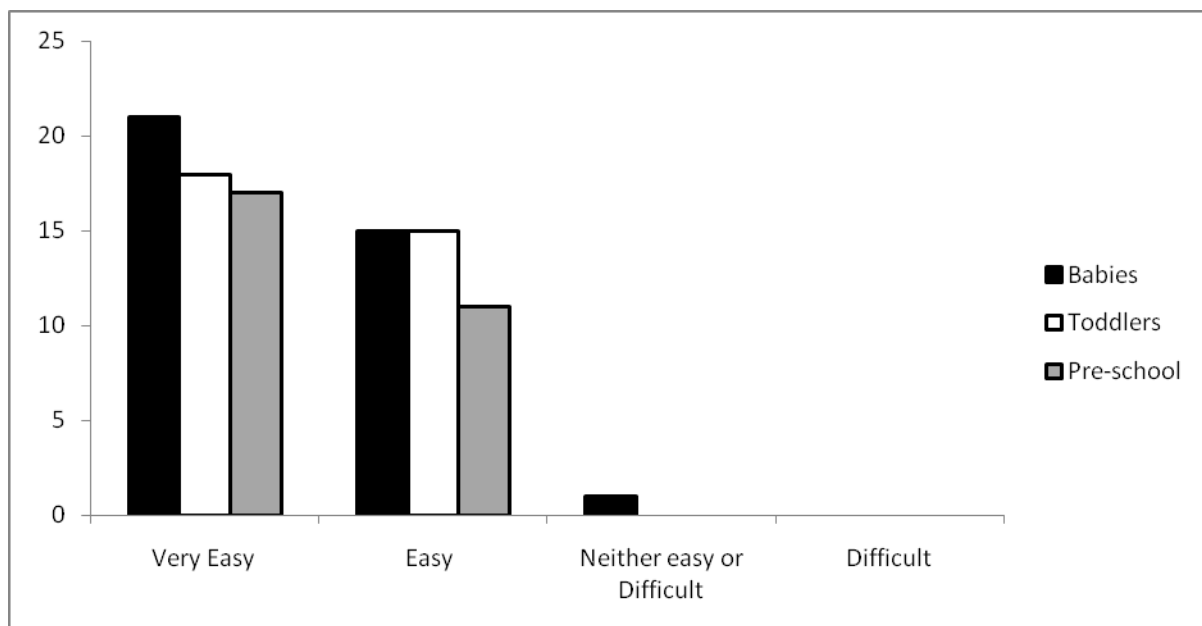
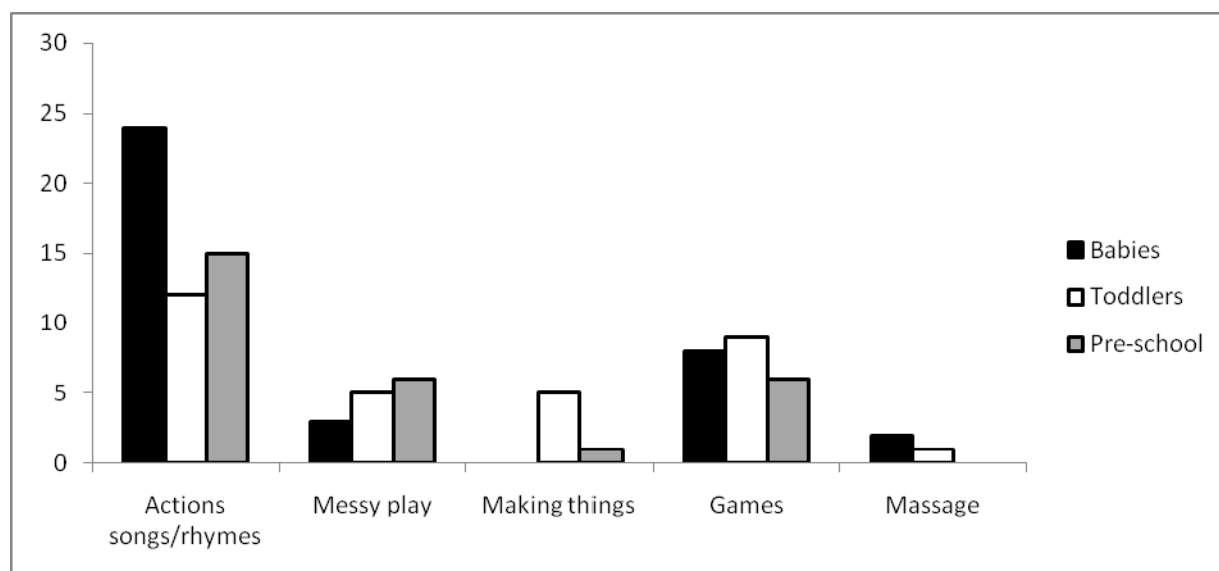


Figure 14 Comparison of age-group specific responses to the question: “Which content section of the book did you most often use?”



Figures 14 and 15 revealed that 66% of Baby, 43% of Toddler and 53% of Pre-school group respondents used the Action Songs/rhymes section of the book most often whilst 44%, 36% and 52% respectively considered the same content section of their age-specific book to be the “most useful”.

Figure 15 Comparison of age-group specific responses to the question: “Which content section of the book did you consider most useful?”

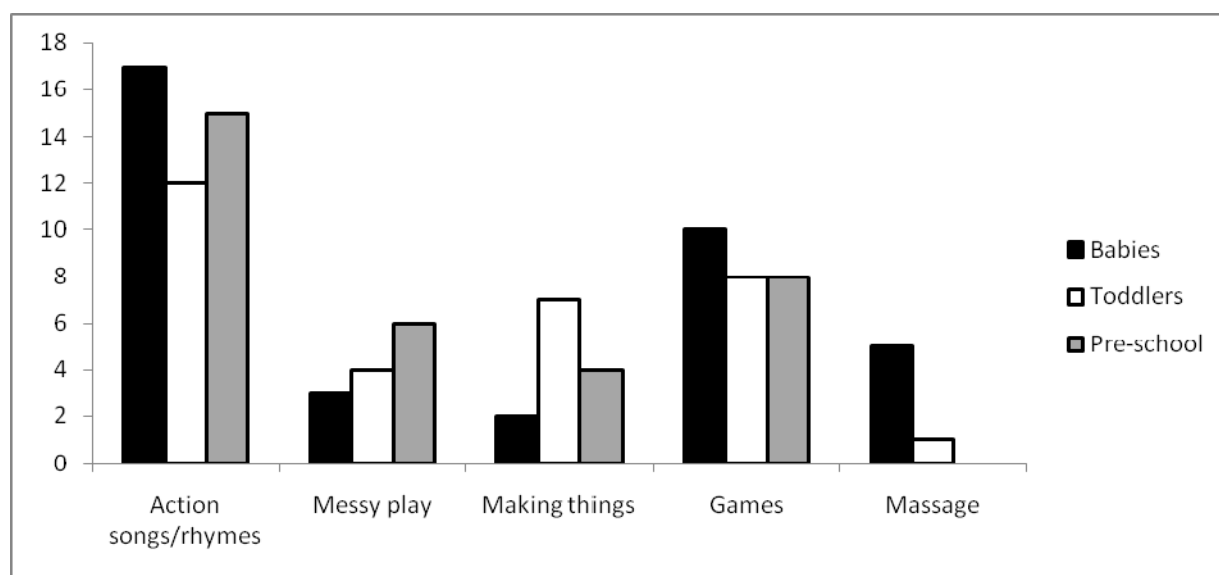


Figure 16 Comparison of age-group specific responses to the question: “How would you rate the overall usefulness of play@home book?”

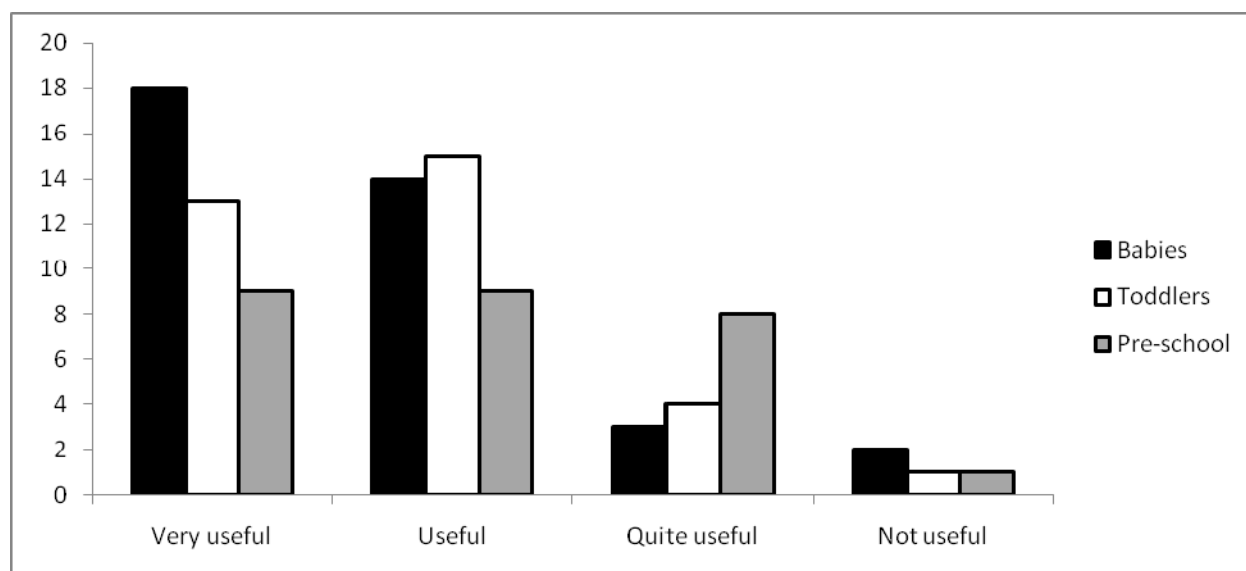


Figure 16 indicates that the majority of Baby, Toddler and Pre-school group respondents (86%, 85%, 62% respectively) rated the play@home resource books as “useful/very useful”.

3.6 Summary of findings

The cross-sectional assessment of baseline data revealed that there were no significant differences for either ASQ or PPS assessment scores between the Intervention and Control Baby group samples. In contrast, statistically significant differences were observed for both ASQ and PPS assessment scores between the Intervention and Control Toddler group samples with the Intervention group reporting (i) higher scores for the ASQ sub-domains of Gross Motor, Fine Motor and Problem Solving, and (ii) higher scores on the Pleasure in Parenting scale. In addition, for the Intervention Toddler group sample alone, a statistically significant correlation was observed between selected sub-domains in the ASQ assessment and the PPS: (i) ASQ Gross Motor & PPS total ($r = 0.29$, $p = 0.007$) and (ii) ASQ Personal Social & PPS total ($r = 0.25$, $p = 0.018$). In the Pre-school samples, no significant differences were observed at baseline between the Intervention and Control groups for the primary outcome of total daily physical activity levels. A statistically significant difference was observed for ASQ assessment scores with the Pre-school Intervention group reporting higher scores for the ASQ Fine Motor skill sub-domain. No significant differences were observed for SAQ responses.

Taken together, and with the caveat that these are cross-sectional observations, these data appear to indicate that the play@home resource was associated with higher levels of development (as measured by the ASQ) amongst Toddler Intervention group children. Exposure to the resource in this age group also appears to be reflected in

reports, by the primary carer, of higher levels of parent-child engagement. This conclusion is based, in part, on the absence of any differences at the time of initial receipt of the resource in the Baby group but the observed presence of such differences between regions at the Toddler stage.

Longitudinal observation assessment data revealed an absence of statistically significant intervention effects for the Baby groups for either ASQ or PPS. Similarly, no significant intervention effects were detected in the Toddler groups for any of the ASQ sub-domains. Although a trend towards statistically significant differences (Intervention > Control) in the post-intervention PPS scores was evident ($P=0.050$) the more robust ANCOVA analysis did not confirm the existence of a significant play@home Intervention region effect over the longitudinal observation period.

Whilst no significant effect of the intervention was detected in the Pre-school group for the primary outcome variable of total daily physical activity (average cpm) a statistically significant effect was observed for the influence of region on % MVPA behaviour. In this case the Pre-school Intervention group increased the amount of time spent in MVPA compared with the Pre-school Control group. No significant effects of the intervention were detected for any of the ASQ sub-domains or the SAQ.

Exit survey information obtained from almost 100 of the play@home intervention group (~33% of the total intervention sample) revealed that well over two thirds of the sampled Baby (86%), Toddler (85%) and Pre-school (67%) participants, found the resource to be either 'Very Useful' or 'Useful'.

4. Discussion

The evaluation study was a broad based ecologically valid comparison of two comparable areas; one where play@home had been introduced and a second comparable area where it had not. There were three groups of children involved, the oldest of whom (“Pre-school” group), had all received play@home from the first year of life. The middle group (“Toddler group”) had received two years of play@home and the youngest (“Babies”), who at the start of the study been in receipt of the resource for a few months only. We compared baseline data on the three groups and because of their exposure to play@home, interpreted differences as at least associated with the introduction of the programme. We then report relatively short longitudinal studies for each of the three groups. In general our findings suggest that the programme is most commonly used by the parents of the younger groups of children rather than the older children. These parents tend to use the play@home resource to give them ideas rather than as a script. The results also appear to support the development of motor skills in the middle group of children as well as higher levels of parent-child interaction. Given the aims of play@home, such findings are both reasonable and acceptable. That said the positive outcome for increased moderate-to-vigorous physical activity in pre-schoolers is an important finding for potential health outcomes.

The demographics of the samples recruited and the baseline outcome assessment data generated indicate that this was a broadly representative sample of Scottish Babies, Toddlers and Pre-school children with ASQ, BMI and physical activity data, in particular, closely approximating established normative data (Squires et al, 2009) and/or published data generated from comparable age group and culturally similar samples (Jackson et al, 2003; Reilly et al, 2004).

Without reiterating earlier discussions, it is clear that there is considerable variability in all our groups which may decrease the chances of obtaining statistically significant results and thereby increasing the chance both of missing differences and obtaining false negative or Type II errors. The fact that we do obtain a number of significant results against this background is important as is the fact that those that are found all go in the same direction, favouring the Intervention site. If the results were a consequence of major selection bias for example with social disadvantage, we might have expected the majority of variables to be significant. Again, if we were simply looking at developmental noise we would expect significant results equally favouring either site throughout the dataset. This was not the case. We can, therefore, be reasonably confident that our results are robust and could be replicated in other sites. We now consider some of the key findings in the study and consider their implications.

4.1 ASQ scores

The baseline cross-sectional comparisons reported provide a “snapshot” of information at entry to the study. These suggest that there may be a positive association between exposure to the play@home resource and selected ASQ sub-domain scores. This observation was only evident in inter-region comparisons of the Toddlers and Pre-school groups. Of particular interest, given the aims of the play@home programme, was the fact that the Intervention sample ASQ values were significantly higher in both the

Gross and Fine Motor skill domains and Problem Solving domain at the Toddler stage and in the Fine Motor skill domain for the Pre-school group. One could plausibly speculate that the absence of any differences in ASQ score (for instance as a proxy for motor skill development) in the Baby group might be anticipated as the intervention group would not yet have experienced sufficient exposure to the resource. In contrast, it could be interpreted that the higher ASQ scores for the Toddler group may reflect a cumulative effect of almost two years exposure to both the Baby and Toddler play@home resource books. By extrapolating this line of argument one might then have expected, at the Pre-school stage, the inter-regional differences between the scores for these ASQ domains to be further widened as a potential consequence of an even longer period (~4 years) of exposure to the “intervention” resources. However, although a difference in ASQ Fine Motor skill was evident between the Pre-school Intervention and Control groups no differences were seen in any other ASQ domain. It is important here to apply some caution to this speculative interpretation in as much as it is based on self-reported data obtained at a single assessment point. Moreover, it is widely acknowledged that developmental status is affected by a myriad of influences that were not all fully accounted for in the design of this study. However, given the matching of the samples across regions for age, gender and SES it is nonetheless interesting that the intervention groups should be significantly “advantaged” in relation to these ASQ domains. This potential “effect” is also supported by some of the information obtained in the Exit survey administered to the Toddler Intervention group sub-sample. Approximately 60% of these exit sample respondents indicated that when using the play@home resource books they mainly engaged in action songs/rhyme activities or game playing and furthermore an equivalent percentage rated these content sections of their age-specific book to be the activities they found “most useful” (see Figure 15 and 16).

4.2 Pleasure in Parenting Scale responses

It was also interesting to note that, for the Toddler group, a similar association might exist in regard to the PPS response data. In this instance the Toddler Intervention group were characterised, during the baseline cross-sectional comparisons, by significantly higher total PPS scores than the comparison Control sample (see Figure 4). Reference to Table 4 in the Results section indicates that this difference in total PPS scores reflected the influence of specific questionnaire items relating to interactions during mealtimes, tidying up after their child, and also taking their child on errands. Although analysis of the post-intervention data set indicated a trend ($P=0.050$) towards the persistence of these higher total PPS for the Toddler Intervention sample at the end of the longitudinal observation the more robust ANCOVA analysis did not reveal a statistically significant region effect. However, the baseline Intervention data appear to reflect a higher degree of carer-child engagement generally but particularly in those tasks which one would conventionally describe as parental chores and not obviously play. In this instance one might also plausibly associate this difference with the Intervention sample’s exposure to the play@home resource.

To some extent these observations, for the Toddler group, are augmented by the revelation of statistically significant correlations between ASQ Gross Motor Skill & PPS total scores ($r = 0.29$, $p = 0.007$) and ASQ Personal Social & PPS total scores ($r = 0.25$, $p = 0.018$). Although these findings indicate a small, but statistically significant, amount of common variance between these assessment variables, it is noteworthy that the relationship (between) PPS and ASQ was only evident for the Intervention sample.

4.3 Physical Activity

The cross-sectional analysis of baseline data revealed no significant differences between regions in terms of the primary physical activity outcome measure (total physical activity as characterised by averaged daily accelerometer counts per minute) with values of $667.1 \pm 197\text{cpm}$ and $676.1 \pm 207\text{cpm}$ for the Intervention ($n=55$) and Control ($n=52$) samples respectively. This observation is based on a combined sample of boys and girls in both regions. Although, as indicated in the Results section, we confirmed the well-established pattern of boys' physical activity exceeding that of the girls we had accounted for this likelihood by sampling broadly equivalent numbers of boys and girls across both areas at baseline (Intervention, boys = 53%, girls = 47%; Control, boys = 52%, girls = 48%) allowing inter-region comparison of physical activity levels based on the combined sample. Prior to constituting the combined sample it was also established that no inter-regional differences existed in physical activity levels for the sub-samples of boys and girls.

Although no significant effect of the intervention was detected in the Pre-school group for the primary outcome variable of total daily physical activity (average cpm) a statistically significant effect was observed for the influence of region on % MVPA behaviour. The Pre-school Intervention group was observed to increase the amount of time spent in MVPA with MVPA % increased by an estimated 0.67% more on average in the Intervention than in the Control group. For the Intervention region this corresponded to a relative increase in daily MVPA of 28% compared with the baseline level. This modest increase in daily MVPA translated into an average increase of 7.2 minutes per day which, if extrapolated across an entire one-week period would constitute approximately 50 minutes of additional MVPA. We believe that this is a genuine effect that is probably diluted somewhat by the phased method of recruitment. Although there is some disagreement in the literature regarding the impact of seasonality on physical activity behaviour in Pre-school children, Fisher et al (2005) reported a significant difference between the seasons for levels of total physical activity. They indicated that the lowest amount of physical activity occurred during springtime and that the greatest amount occurred in the summer. As, of necessity, physical activity data collection was phased in the current study (Start-finish; Winter-Autumn, Spring-Autumn/Winter; Summer-Winter) it is conceivable that the extent of any possible favourable effect of the play@home resource might be "reduced" due to seasonal variation in physical activity levels in those recruited in the Spring-Autumn and Summer-Winter phases. However, as this process was implemented to ensure "matched-season" patterns of recruitment across regions we believe that we may have accounted for any possible seasonal variation effects. This conclusion appears to be supported by the absence of any cross-sectional differences in any aspect of measured physical activity between the regions at baseline. Moreover, our application of the ANCOVA approach

also attempted to control for any similar confounding by employing pre-test scores as the covariate in the analysis.

The current United Kingdom recommendations for physical activity in the pre-school age group are that children should aim to accumulate a minimum of 60 minutes of moderate-to-vigorous physical activity throughout the day (NICE 2009). However, emerging international guidelines indicate that there should be a shift away from the specification of a particular intensity of exercise for this age group. Instead, it is suggested that the focus should now be upon promoting an increase in the total amount of daily physical activity accrued by children in order to minimise the time spent sedentary. Recently developed Australian physical activity guidelines state that 'Pre-schoolers should be active every day for at least three hours, spread throughout the day' (Commonwealth of Australia, Department of Health and Ageing, 2010). The UK-wide Chief Medical Officers report, expected to be released in the summer of 2011 is likely to endorse this recommendation. It is noteworthy that the cross-sectional baseline data analysis indicated that neither of the Pre-school groups in Intervention and Control regions were observed to achieve the age-appropriate recommended levels of physical activity (whether expressed as either of the target thresholds of 60 minutes of MVPA or 180 minutes of total physical activity). In a systematic review of physical activity in pre-school age children, Tucker (2008) found of the 39 studies reviewed, only 54% of studies observe children achieving the 60 minute recommendation for MVPA. When we compared our observations directly with the findings of studies using similar Scottish pre-school samples, activity monitoring and cut-points methods, a high level of agreement was found. Studies by Fisher et al (2005), Kelly et al (2006), Jackson et al (2003) and Reilly et al (2004 & 2006) all reported low levels of MVPA of between 2-4% of activity monitor wear time, which would equate to between 20-30 minutes. Our observations, based on accelerometer assessment of physical activity, are further confirmed by more recent studies conducted in Australia (Hinkley et al 2010) and Portugal (Vale et al 2010). Both studies found children spending long periods of time (85%) in sedentary behaviour, and only 5% of waking time spent in MVPA. Vale et al (2010) also reported that only 27% of their sample accumulated 120 minutes of total activity in a day.

4.4 Study limitations

It is always necessary to express caution with even the most stringently controlled trial of an intervention. The higher the ecological validity of the trial the more likely it is that this will be the case. In this study the research team was able to identify the sites but had no control over the play@home programme or the way that it had been introduced to the parents. The exit interviews provide a hint of how much and how the programme was used but this is only an indication. It would be useful to know how parents had responded to the books provided by the play@home programme to get some sense of the fidelity of the intervention. While it is always tempting to assume that early intervention is a good thing and will lead to results in practice, it is optimistic to assume that the provision of books in themselves would substantively change a parent's behaviour such that it would affect a child's development. Indeed, if we return to the

results of parenting studies, those that “work” are almost always those that provide a period of concentrated 1:1 or group work, rather than handing out materials. Against this it is acknowledged that the play@home programme is delivered through professional networks which support delivery of information to parents and positively encourage engagement with the activities within the resources

4.5 Implications for practice

play@home provides an additional resource that practitioners can access to support all families across Scotland. It is necessary to find ways that it can be incorporated into practice as it may encourage parents to observe their children’s behaviour and encourage them to raise appropriate concerns based on their observation. If they do engage in the programme and they certainly seem to do so at some level, this could provide an addition to the type of health improvement information currently in operation in most health boards. Some years ago, the policy document Health for all Children (Hall and Elliman, 2005) advocated removing the responsibility for some types of formal identification processes from practitioners thereby shifting the balance on to parents. Practitioners then expressed concern that this process was accentuating the inverse care law. This was obviated to some extent by Sure Start in England but that too has been criticised for being under used by those who are most disadvantaged. The play@home programme may offer an additional resource for practitioners to inform and support families and this has been identified in the New Look at Hall 4 (Scottish Government 2011) promoting play@home as core health improvement information for parents.

4.6 Implications for policy

play@home is a universal public health type intervention made available to all parents in Scotland. Reflecting what we know about other public health interventions we might expect this type of intervention to exacerbate health inequalities (White and Adams, 2009), with those in the higher demographic quintiles making greater use of the programme. This does not appear to be the case. In the first instance all the relevant groups were sampled increasing confidence that results cannot be attributed to selection bias. But it is also true that the intervention does not appear to have favoured the more advantaged. This is relevant in the context of the “proportionate universalism” advocated by the recent Marmot Report (Marmot, 2010). It may be that explicitly focusing on play activities we may reduce the need for a host of other “early intervention” activities which have similar objectives but are less well received by parents. Similarly this type of intervention might be just the type of procedure which would foster exactly the type of skills identified the recent report *Independent review on Poverty and Life Chances* submitted to the UK government (Field, 2010).

4.7 Implications for research

As many others have shown, examining the effects of programmes to encourage physical activity is a legitimate exercise. Our conclusion from these results would be

that to do this more focused behaviour modification programmes are more likely to obtain the desired result. The interesting feature about play@home is that it purports to cover many outcomes. The risk is that this dilutes the effect and does not allow us to conclude anything about what it is that makes it work. More careful teasing apart of these key ingredients would be a useful first step. As indicated above the delivery of the programme should be more carefully controlled in future evaluations to ensure that we have some idea of the right amount of input to parents and they in turn to their children. Finally it would have been helpful to include an economic element to the programme, to cost the input, which is almost certainly modest, and to explore the implications of costing from the parental perspective.

5. Conclusions

In conclusion, the play@home intervention, as administered in the present study, gives indicative evidence of positive outcomes, especially those related to motor skill, personal/social development and parenting in the early stages (Toddler group). The fact that the longitudinal observations did not reveal any additional differential gains in gross motor skills or parent-child interactive behaviour across the observation period is disappointing but does not detract from the strength of the baseline differences which appear to reflect the principal aims of the programme. Our finding that the children's fine motor skills were also ahead in the Pre-school intervention group suggests a potentially very real benefit to be had in an area which is fundamental to school readiness. Pleasingly, given the original aims of the play@home programme, we also saw a modest, but potentially important, improvement in moderate-to-vigorous-physical activity levels amongst the Pre-school intervention group.

It is recognised that properly conducted, sufficiently intensive parenting interventions can work. Given the relative lack of control in this study it is heartening to find the results that we have. Parents, especially those of the younger children, do seem to respond well to the play@home resource literature and it does appear to lead to some positive results. This is an important observation given the increasingly strong focus on the Early Years (0-3 years of age) in Scotland (Deacon, 2011; Scottish Government, 2008).

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